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ANNUAL REPORTS

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE YEAR ENDED JUNE 30,

1910.

REPORT OF THE
SECRETARY OF AGRICULTURE.

REPORTS OF CHIEFS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1911.

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[CHAPTER 23, Stat. at L., 1895.]

[AN ACT providing for the public printing and binding and the distribution of public documents.]

* * * * * * *

Section 73, paragraph 2:

The Annual Report of the Secretary of Agriculture shall hereafter be submitted and printed in two parts, as follows: Part One, which shall contain purely business and executive matter which it is necessary for the Secretary to submit to the President and Congress; Part Two, which shall contain such reports from the different bureaus and divisions, and such papers prepared by their special agents, accompanied by suitable illustrations, as shall, in the opinion of the Secretary, be specially suited to interest and instruct the farmers of the country, and to include a general report of the operations of the department for their information. There shall be printed of Part One, one thousand copies for the Senate, two thousand copies for the House, and three thousand copies for the Department of Agriculture; and of Part Two, one hundred and ten thousand copies for the use of the Senate, three hundred and sixty thousand copies for the use of the House of Representatives, and thirty thousand copies for the use of the Department of Agriculture, the illustrations for the same to be executed under the supervision of the Public Printer, in accordance with directions of the Joint Committee on Printing, said illustrations to be subject to the approval of the Secretary of Agriculture; and the title of each of the said parts shall be such as to show that such part is complete in itself.

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CONTENTS.

REPORT OF THE SECRETARY.

	Page.
Agricultural production of 1910	9
Prices of farm products	19
Population, crop yields, and prices	26
Proposed department or bureau of public health	30
Enforcement of the food and drugs act	32
Work of the department in 1910	33
Office of the Solicitor	33
Changes in the personnel	36
Weather Bureau	36
Bureau of Animal Industry	42
Bureau of Plant Industry	53
Forest Service	86
Bureau of Chemistry	98
Bureau of Soils	107
Bureau of Entomology	113
Bureau of Biological Survey	121
Division of Accounts and Disbursements	131
Division of Publications	133
Bureau of Statistics	135
Library	137
Office of Experiment Stations	138
Office of Public Roads	152
The handling of perishable products	157

REPORTS OF CHIEFS.

Report of the Chief of the Weather Bureau	161
Mount Weather Research Observatory	161
Forecasts and warnings	166
River and Flood Division	172
Instrument Division	175
Climatological Division	177
Marine Division	180
Library	183
Examinations for promotion	185
School of instruction	185
Distributing Division	185
Telegraph Division	189
Publications Division	190
Division of Supplies	190
Observatory buildings	191
Personnel of the bureau	193
Changes in the force of the bureau	194
Statistics of the service	196

Digitized by Google

	Page.
Report of the Chief of the Bureau of Animal Industry	199
Introduction	199
Meat inspection	199
Proposed department or bureau of public health	202
Study and eradication of contagious diseases of animals	204
Breeding horses for the United States Army	208
New experimental farm	208
Need for another animal quarantine station on the Atlantic seaboard	209
Needed legislation	209
Veterinary education	211
Publications and diffusion of information	211
The Animal Husbandry Division	211
The Dairy Division	229
The Inspection Division	242
The Quarantine Division	248
The Pathological Division	257
The Biochemic Division	266
The Zoological Division	272
The Experiment Station	274
Report of the Acting Chief of the Bureau of Plant Industry	279
General work of the year	279
Laboratory of plant pathology	281
Pathological collections and inspection work	282
Fruit-disease investigations	282
Investigations in forest pathology	285
Cotton and truck-crop diseases and sugar-plant investigations	286
Soil bacteriology and water-purification investigations	287
Crop physiology and breeding investigations	288
Acclimatization and adaptation of cotton, corn, and other crops	291
Drug-plant, poisonous-plant, and general physiological investigations	295
Agricultural-technology investigations	300
Fiber-plant investigations	303
Taxonomic and range investigations	304
Seed-testing laboratories	307
Grain standardization	308
Grain investigations	309
Corn investigations	314
Tobacco investigations	315
Plant-nutrition investigations	318
Dry-land agricultural investigations	319
Western agricultural extension	320
Alkali and drought-resistant plant breeding	323
Physical investigations	325
Farm-management investigations	325
Farmers' cooperative demonstration work	335
Arlington Experimental Farm and horticultural investigations	339
Pomological collections	343
Field investigations in pomology	343
Greenhouses, gardens, and grounds	352
Foreign seed and plant introduction	355
Forage-crop investigations	358
Congressional seed distribution	360
Report of the Forester	363
Classification of expenditures	363

Digitized by Google

Report of the Forester—Continued. Page.
The National Forests 364
Federal cooperation 406
State and private cooperation 406
Other investigations 408
Miscellaneous 419
Work for the ensuing year 419
Report of the Chemist 429
Important food investigations 429
Drug investigations 439
Special investigations 447
Feed and drug inspection 453
Miscellaneous investigations 478
Publications 485
General business operations 485
Work planned for the fiscal year 1910–11 486
Report of the Chief of the Bureau of Soils 493
Progress of the soil survey 493
Chemical and physical laboratory investigations 501
Soil-fertility investigations 503
Soil-water investigations 506
Report of the Entomologist 509
Work of the year 509
Proposed work for the fiscal year 1911 546
Plans for work recommended for year ending June 30, 1912 548
Report of the Chief of the Bureau of Biological Survey 549
Work of the Biological Survey 549
Outline of work for 1911 564
Report of the Chief of the Division of Accounts and Disbursements 567
Character of work 567
Organization 567
Work of the year 568
Finances of the department for 71 years 591
Report of the Editor 621
Work of the year 621
Work of the division for 1911 640
Recommendations for 1912 640
Publications issued during the year 642
Report of the Chief of the Bureau of Statistics 695
Introduction 695
Organization 695
Changes in the monthly crop reports 696
Plans for the year ending June 30, 1911 699
Work of the Division of Production and Distribution 700
Work of the Editorial Division and Library 702
Work of the Division of Domestic Crop Reports 704
Crop condition reports 706
Production and population 708
The increased cost of living 716
Report of the Librarian 723
Work of the year 723
Rooms 723
Use of the library 724
Library publications 726

Digitized by Google

Report of the Librarian—Continued.	Page.
Mailing lists and foreign exchanges	726
Accessions	727
Periodicals	728
Binding	729
Duplicates	729
Catalogues	730
Catalogue cards for Department of Agriculture publications	732
Bureau and division libraries	732
Agricultural Libraries Section, American Library Association	733
Report of the Director of the Office of Experiment Stations	735
Introduction	735
Relations with agricultural experiment stations	735
Relations with institutions for agricultural education	739
Publications of the office	745
Work for the Civil Service Commission	748
Insular stations	748
Irrigation investigations	757
Drainage investigations	762
Nutrition investigations	765
Report of the Director of the Office of Public Roads	767
Work of the year	767
Outline of plans for the current year	792
Plans and recommendations for 1912	792
Report of the Solicitor	793
Outline of office work	793
Administration of acts of Congress	796
Legal work for the Forest Service	870
Miscellaneous cases	885
Preparation of legal instruments, contracts, leases, and bonds	886
Patents for department employees	888
Committee on personnel	889
Publications of the office	890
Status of office work	890
General and special orders of the Secretary of Agriculture issued during the fiscal year 1910	891
Report of the Appointment Clerk	897
Changes in the force of the department	897
Establishment and growth of the Department of Agriculture	900
Addenda	916
Index	917

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REPORT OF THE SECRETARY OF AGRICULTURE.

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REPORT

OF THE

SECRETARY OF AGRICULTURE.

Mr. PRESIDENT:

I respectfully present my Fourteenth Annual Report, covering the work of the Department of Agriculture for the year 1910.

AGRICULTURAL PRODUCTION OF 1910.

HIGHEST VALUE EVER REACHED.

PROSPERITY MAINTAINED.

Year after year it has been my privilege to record "another most prosperous year in agriculture." Sometimes the increased prosperity has been due to weather unusually favorable to agriculture, sometimes to higher values caused either by a greater yield or demand or by greater money returns due to a scant production; but usually the advance in farmers' prosperity has been in spite of various drawbacks. It would seem that this country is so large in extent and has such varied climate, soil, and crops that no nation-wide calamity can befall its farmers. Combined with this strong position in agriculture, the Nation may now begin to derive increased confidence in its agriculture because of improvements that are permeating the whole country in consequence of a grand movement sustained by the National Department of Agriculture and the various state agencies.

VALUE OF ALL PRODUCTS.

Nothing short of omniscience can grasp the value of the farm products of this year. At no time in the world's history has a country produced farm products within one year with a value reaching $8,926,000,000, which is the value of the agricultural products of this country for 1910. This amount is larger than that of 1909 by $305,000,000, an amount of increase over the preceding year which is small for the more recent years.

The value of farm products from 1899 to the present year has been progressive without interruption. If the value of that census year be regarded as 100, the value of the agricultural products of 1900 was 106.4; that of 1901 was 112.7; that of 1902 was 119.1; that of 1903

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was 124.8; that of 1904 was 129.8; and that of 1905 was 133. The year 1906 was an extraordinary one for agriculture, both in quantity and in value of production. The value increased to 143.4, as compared with 100 representing 1899. In the next year, 1907, the value of agricultural products rose to 158.7; in the next year, 1908, to 167.3; in 1909 to 182.8; and in 1910 to 189.2, or almost double the value of the crops of the census year eleven years preceding. During this period of unexampled agricultural production, a period of twelve years during which the farmers of this country have steadily advanced in prosperity, in wealth and in economic independence, in intelligence and a knowledge of agriculture, the total value of farm products is $79,000,000,000.

CHIEF CROPS.

In the statement that follows concerning the crop quantities and values for 1910, no figures should be accepted as anticipating the final estimates of this Department to be made later. Only approximations can be adopted, such as could be made by any competent person outside of this Department. All values are for products at the farm, unless otherwise stated, and in no item are values at the produce or commercial exchange.

CORN.

A National asset amounting to 3,000 million bushels, worth 1,500 million dollars, is found in the corn crop. Its production this year was 3,121,381,000 bushels, a crop that exceeds that of even the great agricultural year 1906. It is greater than the average crop of the preceding five years by 14 per cent.

A notable feature of corn production this year is the growing importance of the South. This has been manifested in a small way in very recent years, but now the increased magnitude of the crop in that section, both absolute and relative to National production, forces itself upon the attention.

Let a comparison be made with corn production in the South in the census year 1889, or twenty-one years ago. At that time the South Atlantic States produced only 6.2 per cent of the National crop of corn. This year they produced 9.1 per cent, or an increase relatively of about one-half. The relative increase for the South Central States is even greater, being from 14.8 per cent of the National crop of 1889 to 23.4 per cent in 1910. Then the South produced hardly more than one-fifth of the National crop; now it produces one-third.

The power that this increased corn production gives to southern farmers with respect to independence, release from buying feeding stuffs, in producing meat, and maintaining dairy and other domestic animals is well understood.

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While the value of this corn crop is below that of 1909 and also of 1908, its amount belongs to stories of magic. It can hardly be reckoned at less than $1,500,000,000, a sum sufficient to cancel the interest-bearing debt of the United States, buy all of the gold and silver mined in all of the countries of the earth in 1909, and still leave to the farmers a little pocket money.

The corn crop is a National asset in more than one sense. It is not merely wealth in existence for the time being, but it is an asset of perpetual recurrence. Year after year, throughout the ages, a stupendous amount of corn, with incredible value, can be produced.

The cotton crop, including seed, is worth this year only three-fifths of the value of the corn crop; the wheat crop only two-fifths; the hay crop, less than one-half. All of the cereals, except corn, are together worth only three-fourths as much. The great allied iron and steel industries had in the latest census year for which results have been published, 1904, a production worth only 60 per cent of the value of this year's corn crop.

COTTON.

For many years the cotton crop was fourth in value among the crops, being exceeded usually by corn, wheat, and hay. But in those days the price of cotton was very low. The crop of this year may be worth in lint and seed a round $900,000,000 at the farm, or more than the corn crop was worth in any year prior to 1901, or more than the wheat or hay crop was ever worth.

Apparently the cotton crop of this year, including seed, is worth $129,000,000 more than the crop of last year, and that crop was far above any previous one in value. During the last five years the cotton crop had an average value of $685,000,000, so that the value for this year is 13 per cent above the five-year average.

The number of bales in this year's cotton crop will be determined by the Bureau of Statistics of this Department in December, and at the present writing no forecast of that estimate can be suggested. From commercial sources, however, it is evident that the cotton production of this year will be considerably short of being a record breaker, although possibly it may be the fourth in order of magnitude that this country has produced.

The average cotton crop of the preceding five years had a weight which perhaps is not far from most of the commercial estimates for the crop of this year.

HAY.

Wheat has often contended with hay as to precedence in value and the place in 1910 goes to hay, notwithstanding its short crop. The value of the hay crop is about $720,000,000, an amount which has been exceeded but once, and that in 1907, when the crop was

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worth $744,000,000. Indeed, the value of the crop of this year is much above that of the high crop values of other preceding years, illustrating the principle that a somewhat deficient crop is usually worth more in the aggregate than an abundant one. The value of the crop of this year is 13 per cent above the average of the preceding five years.

The quantity of the hay crop is 60,116,000 tons, and has been exceeded a dozen times. It is 5 per cent below the average crop of the preceding five years. The feeding value of the hay crop, however, is greater than its tonnage implies. Alfalfa has entered into the production of this crop in recent years and has now become in itself a crop of large proportions.

In relative geographic distribution, the hay crop has changed perceptibly during the twenty-one years since the census year 1889. During the interval the North Atlantic States have increased their production of the National crop from 24.3 to 27.8 per cent; the Western division, 7.9 to 16.4 per cent; the South Atlantic, from 3.1 to 3.9 per cent; the South Central, from 3.3 to 5.8 per cent; the two southern groups of States, from 6.4 to 9.7 per cent; and consequently, the North Central States have lost relatively in a marked degree, or from 61.4 to 46.1 per cent of the National crop.

WHEAT.

Fortunately the wheat crop is divided into two sowings, autumn and spring, and consequently it is not improper to regard wheat as having two crops. These to some extent cover the same territory, but they belong largely to different geographic areas, subject to different climatic accidents, with the frequent result that one of the crops is a successful one and the other is not. Such was the fact this year, when the winter crop was a large one and the spring-sown crop suffered from severe drought.

The production of both crops this year is 691,767,000 bushels, or substantially the average of the preceding five years, whereas the value is about $625,000,000, or 7.6 per cent above the five-year average.

The quantity of this year's wheat crop has been exceeded four times, but the value has been exceeded only once, in 1909, although the crop of 1908 was nearly as valuable.

Wheat is another crop that has undergone perceptible change in relative geographic distribution since the census year 1889, but in a less degree than corn and hay. During the twenty-one years the fraction of the National crop produced in the North Atlantic States declined from 6.8 to 5.9 per cent; in the North Central States, from 68.6 to 62.9 per cent; whereas there were increases in the other

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geographic divisions—from 5.9 to 6.6 per cent in the South Atlantic; from 5.2 to 9.7 in the South Central; and from 13.5 to 14.9 in the Western States.

OATS.

Easily the fifth crop in point of value is oats, a position that it has long occupied. The value this year is probably over $380,000,000, and has been exceeded in this respect only by the crop of 1909. Compared with the average value of the five preceding years, this year's value is 12 per cent greater.

In quantity the crop of this year is a magnificent one. For the second time in the history of this country the crop exceeds one billion bushels, the precise estimate standing at 1,096,396,000 bushels, or about 90 million bushels above the great crop of 1909. The crop of this year is 22 per cent greater than the average of the five previous years.

The production of this crop has shifted somewhat into the South Central and Western States in comparison with the National production since 1889. The share of the North Atlantic States has declined from 10.3 to 8.6 per cent; of the South Atlantic States, from 2.9 to 2 per cent; of the North Central States, from 79.7 to 77.2 per cent; the South Central States gained the difference between 4.7 and 6.5 per cent; the Western States the difference between 1.9 and 5.7 per cent.

POTATOES.

Next in order of value is the potato crop, which was exceeded in only two or three former years. Compared with the average value of the five previous years, the value for this year is 1 per cent greater. With the exception of the crop of 1909, which was in a degree an overproduction, the crop of potatoes this year was the largest ever grown in this country, the preliminary estimate of this Department being 328,787,000 bushels. This quantity is 8 per cent greater than the average for the preceding five years.

SUGAR.

Beet-sugar production in 1910 has been subject to vicissitudes of climate and other influences. A smaller acreage of sugar beets was planted in Colorado; there was a lack of moisture necessary to a full crop in Utah and Idaho; whereas the production of California, Michigan, Wisconsin, and other States considerably exceeds that of last year, partly due to three new operating factories. Five new factories will be in operation in 1911—two in California and one each in Colorado, Utah, and Nevada. All acreage planted this year returned beets excellent in both quality and quantity.

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It is too early now to forecast accurately the production of beet sugar for 1910, but the indication is that the crop will be about as large as that of 1909, or, say, 512,000 short tons. The factory value of this sugar is about $51,000,000, or hardly less than the value of the crop of 1909, which was the record year.

Commercial estimates indicate that the cane-sugar crop of this year will be about 347,000 short tons, which has been frequently exceeded in recent years. The factory value of this sugar is about $28,000,000, an amount that has been exceeded in four years.

If prospects are realized, the entire sugar crop of factory production, beet and cane combined, will be about 859,000 short tons, or a production that has been exceeded in only one year, 1909. In factory value the two sugar crops will equal about $79,000,000, and if to this be added the value of molasses, sirup, beet pulp, and sorghum and maple products, the combined value of the production of sugar, sirup, and molasses, with subsidiary products, is about $97,000,000, or only $4,000,000 under the high-water mark of 1909.

TOBACCO.

The tobacco crop has slightly exceeded the production of the record year 1909, and its 967,150,000 pounds are 26 per cent above the average production of the five preceding years.

Apparently the tobacco prices of 1909 are barely maintained for the crop of this year, and the total value of the crop is therefore about the same as it was for the crop of 1909, or, say, $95,000,000. No tobacco crop previous to 1909 was worth its amount by fully 20 million dollars.

Tobacco, under the better prices of recent years, is steadily climbing upward in production. The average prices for the last five years, including 1910, have been 10 cents a pound and a little better. It seems to be required that the average price of the crop, all types and grades included, shall not decline if this crop is to maintain its increasing production.

BARLEY.

Barley this year has hardly maintained the average production of the preceding five years, the production of this year being 158,138,000 bushels, as compared with the five-year average of 161,240,000. This year's crop, however, has been exceeded only three times, in 1909, 1908, and 1906.

In point of value the crop of 1910 has been exceeded only in 1907, and the value of this year is 16 per cent above the average of the previous five years.

The price of barley suddenly increased about 60 per cent, to 66.6 cents in 1907, after which it declined to about 55 cents a bushel in

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1908 and 1909; but a higher price than this is indicated for the crop of this year.

In relative geographic redistribution of the barley crop since 1889, the share of the North Atlantic States has declined from 12.2 to 2 per cent, while the share of the North Central division of States has increased from 60.3 to 62.8 per cent, and that of the Western States from 26.9 to 34.4 per cent.

FLAXSEED.

Flaxseed follows barley in order of importance of value of crop. At this writing the indication is that the value of the flaxseed production of this year will be about $33,000,000, which would be the record amount were it not for the greater value of the crop of 1909. Compared with the previous five years, the value of this year's crop is 13 per cent greater.

While the value of this year's crop remains near the top, the production is far below that of recent years, the preliminary estimate being 15,050,000 bushels.

The low production and high value of the flaxseed crop are reconciled in the high price of flaxseed per bushel beginning early in this year. The November 1 price at the farm in 1908 was $1.08; in 1909, same month, $1.40; and in 1910, same month, $2.29.

RYE.

Next in order of value is the rye crop, the 32,088,000 bushels being worth at the farm about $23,000,000. This crop is constant in production and varied little in value in recent years. A larger share of the National crop is now produced in the North Atlantic States than in 1889, the increase being from 28.4 to 33.9 per cent. During this time the North Central States have declined in their share from 63.2 to 57 per cent.

RICE.

Rice production in 1910 remains substantially at the figure of 1909, or, say, a little over 1,000,000,000 pounds of rough rice. No year previous to 1909 produced as large a crop; it exceeds the average of the previous five years by 25 per cent.

The price of rice, however, has declined, so that the crop of this year is worth hardly $16,000,000, or about the same as the crops of 1906 and 1907. This value has been exceeded in 1908 and 1909, so that the value of this year's crop is about 2 per cent below the five-year average.

HOPS.

The estimates of persons outside of this Department indicate that the hop crop of this year will be 13 per cent below the average quantity of the preceding five years, and the smallest crop in a dozen

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years or more. The farm price of hops in 1910 has improved somewhat over the average of the previous five years, so that the total value of the crop of this year is 3 per cent above the five-year average.

ALL CEREALS.

For transportation purposes and as a rough indication of the production of all cereal crops, a statement of the total production of these crops in bushels is interesting. In no previous year has the production of these crops equaled the 5,140,896,000 bushels of the cereals of 1910. The production of this year is 13 per cent above that of the five-year average, which is about 4½ billion bushels.

In value, however, the cereals of this year fall below that of 1908 and 1909, principally on account of the decline in the farm price of corn. This year's value is $2,710,000,000, or about $230,000,000 below the total for 1909 and $50,000,000 below that of 1908; however, it is 11 per cent above the five-year average.

SUMMARY OF COMPARISONS.

This is the year of highest production for corn, oats, the total of all cereals, and for tobacco. But the only crop that reached its highest value this year is cotton.

The list of crops that stand next to the highest, either in quantity or value, or both, is much larger than the foregoing. In production next to the highest year are found for 1910 the crops of rice, hay, beet sugar, and the total for all sugar. In the list of the crops that are next to the highest in value are wheat, oats, barley, tobacco, flaxseed, beet sugar, and the total for all sugar.

The potato crop was third in order of quantity and the corn crop and the total for all cereals were third in value. Barley and rye were fourth in production and potatoes fourth in value. Fifth in production was wheat and fifth in value rice.

The average production of the five years preceding 1910 includes the remarkably productive year 1906 and was generally a period of vigorous production. Notwithstanding the high character of the period, the production of 1910 is above the five-year average in the case of corn, oats, rice, rye, buckwheat, beet sugar, the total for all sugar, potatoes, tobacco, and wool.

In comparison with the average of the preceding five years the value of the crops of this year was greater in the cases of corn, wheat, oats, barley, rye, buckwheat, cotton, beet sugar, the total for all sugar, flaxseed, hay, potatoes, tobacco, and hops.

The value of the farm products of 1910 shows both gains and losses in comparison with 1909. A gain of $130,000,000 is made for cotton lint and seed, $30,000,000 for hay, and $3,000,000 for barley.

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A loss was suffered in wheat, amounting to $104,000,000; corn, $98,000,000; oats, $26,000,000; potatoes and wool, $23,000,000 each.

The farm value of the cereal crops declined $230,000,000 in 1910 from 1909, and the value of all crops declined $119,000,000. A gain was made, however, in the value of animal products, amounting to $424,000,000. It has been a year of high prices for meat and animals, for poultry and eggs, and for milk and butter, and for these reasons the total value of all farm products increased in 1910 $304,000,000 above the estimate for 1909.

FOREIGN TRADE IN AGRICULTURAL PRODUCTS.

THE TRADE BALANCE.

Until 1898 there was ever a balance of trade against the United States in merchandise other than farm products; in that year for the first time the exports of merchandise other than farm products exceeded in value the imports. From 1898 to 1902 the value of exports of merchandise other than farm products exceeded that of imports, and again from 1904 to 1909. The contrary was true for 1903 and 1910, the adverse balance of the last year for manufactures and other merchandise not produced on the farm being $10,926,193.

On the other hand, in the case of farm products there has been an almost unbroken balance of trade in favor of the United States as far back as inquiry has been made. From 1851 to 1863 is found this favorable balance and also from 1866 to the present time. During the five-year period 1886–1890 the farmer's balance of trade in favor of this country averaged $206,265,002; during the next five years the average was $257,666,800; in the five years that followed the average was $386,637,041; during the period 1901–1905 the average was $431,234,941; and during the last five-year period, 1906–1910, the average was $433,683,775. The increase in this quinquennial average has been unbroken since 1886–1890.

Except for two years, 1898 and 1901, the highest balance of trade in favor of this country in the matter of farm products was $488,004,797 for 1908, a year which seems to mark the culminating point in the course of the balance of trade in farm products. In 1909 the balance declined to $274,210,152, and in 1910 the decline continued to $198,090,925. It may be that in 1910 there was not that National surplus of agricultural products to export which the country had offered to other nations of the earth in years preceding. But, however this may be, it is a fact recognized in the exporting trade that the prices of farm products in the fiscal year 1910 were high enough to prevent that free export movement which before existed.

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In consequence of the favorable balance of trade in farm products, the entire foreign trade of the United States in merchandise has exhibited a surplus of exports over imports almost constantly since 1875.

EXPORTS.

The value of the exports of farm products, after constant oscillation, increased to the enormous amount of $1,017,396,404 in 1908, from which there was a decline in 1909 and another in 1910, for which latter year the amount stands at $871,107,067, a value which has been exceeded only in the years 1901 and 1906 previous to 1907.

In the exports of 1910 the principal item was cotton with a value of $450,447,243. Next in order stands packing-house products with a value of $135,959,373; third in order are grain and grain products valued at $133,320,418; after which are tobacco, $38,115,386; oil and oil-cake meal, $19,251,012; fruits, $18,504,591; live animals, $17,447,735. Compared with 1909, there was a decrease in all of the principal items except in cotton, for which the increase was about $33,000,000, fruits about $2,500,000, and tobacco about $7,000,000.

Farm products as an element of the value of domestic exports have had a decreasing ratio from about 80 per cent at the middle of the nineteenth century to 61.6 per cent in 1900, 55.1 per cent in 1909, and 50.9 per cent in 1910.

IMPORTS.

The imports of farm products have constantly increased in value throughout the history of this country's international trade. They constituted about 25 to 33 per cent of the value of all imports at the middle of the nineteenth century and they increased to 50 per cent and over at the end of that century, since which time they have varied, but have not reached 50 per cent subsequent to 1899. The fraction for 1910 is 44.1 per cent of the value of all imports.

In absolute instead of relative value, however, the imports of farm products have constantly increased until they reached the enormous total of $687,486,188 in 1910, an amount much above that of 1909 and still further above the more prominent amounts of the preceding years.

Among the more prominent imports of agricultural products for 1910 are packing-house products, $130,140,313, mostly hides and skins; sugar and molasses, $107,716,367; coffee, $69,194,353; silk, $67,119,108; wool, $51,220,844; vegetable fibers, $48,234,977; tobacco, $27,756,133; fruits, $24,177,160.

Increases are found, 1910 over 1909, in packing-house products, wool, vegetable fibers, fruits, sugar and molasses, and tobacco.

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FOREST PRODUCTS.

The value of the exports of domestic forest products was never so high as in 1910, except for the years 1907 and 1908. In 1910 the value is $85,054,602, and the highest amount ever reached, which was in 1907, was $92,948,705. The value of exported naval stores in 1910 was $18,681,962, a value larger than that of 1909, but smaller than that of other recent years.

The imports of forest products consisted mostly of india rubber, wood pulp, pulp wood, and woods not grown in the United States. Their value in 1910 is $179,610,886, which is by far the highest annual value of imports. It was not until 1907 that the value of these imports exceeded $100,000,000.

PRICES OF FARM PRODUCTS.

FARMER'S SHARE OF CONSUMER'S COST.

AN EQUALIZING PROCESS.

High prices was one of the subjects of my annual report for 1909. It was shown that for many years previous to about 1897, or a little later, the prices of farm products received by farmers were even less than the cost of production, and often little if any above that cost, so that during a long period of years the farmer was not thriving. It was shown also that in the upward price movement, which began about 1897, the prices received by the farmer have advanced in greater degree than those received by nearly all other classes of producers. That this should have been so was merely a matter of justice to the farmer to equalize the reward of his efforts with the rewards received in other lines of production.

INCREASE OF BEEF PRICES.

The price received by the farmer is one thing; the price paid by the consumer is far different. The distribution of farm products from the farm to consumers is elaborately organized, considerably involved and complicated, and burdened with costly features. These are exemplified in my report for 1909 by a statement of the results of a special investigation into the increased cost of fresh beef between the slaughterer and the consumer.

It was established that in the North Atlantic States the consumer's price of beef was 31.4 per cent higher than the wholesale price received by the great slaughtering houses; 38 per cent higher in the South Atlantic States; and 39.4 per cent higher in the Western States. The average for the United States was 38 per cent.

It was found that the percentage of increase was usually lower in the larger cities than in the smaller ones and higher in the case of

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beef that is cheap at wholesale than of high-priced beef. It was a safe inference that the poorer people paid nearly twice the gross profit that the more well-to-do people paid.

THE DAIRYMAN GETS ONE-HALF THE MILK PRICE.

Another investigation into the increase of prices in the process of distribution was made in the last week of June, 1910. This time the object was to discover what fraction of the consumer's price was received by the farmer. It was a time of high prices, of high cost of living, and the aim was to ascertain to what extent the farmer received a return out of the high consumer's cost of farm products.

The investigation covered 78 cities scattered throughout the United States, and the information was contributed by a large number of the Department's crop correspondents and by some of its special agents, who made inquiries in all of the 78 cities. The cities were divided into geographical groups for the purpose of computing averages, and these were combined into an average for the United States, all after proper weighting according to importance.

Milk was one of the commodities under investigation—a food product indispensable to a large fraction of the families of the Nation, and now a costly one to all consumers.

While it is true that the dairyman is receiving considerably more for his milk than he did before the present era of high prices, yet it was discovered in this investigation that throughout the United States he receives a scant 50 per cent, or one-half of the price paid by the consumer. The other half goes to the railway company for carriage, to the wholesale milk dealer, if there is one in the chain of distribution, and to the retailer who delivers at the consumer's door.

Freight charges for carrying milk vary according to distance, but their average may be regarded as approximately about 7 per cent of the consumer's price. With the farmer receiving about 50 per cent of that price and the railroads 7 per cent, the remaining 43 per cent of the consumer's price is received mostly by the retailer.

The milk wagon of the retailer has a long route. It stops at a house or two in one city block, perhaps passes several blocks without stopping, and so proceeds to serve customers thinly distributed along a route of miles. At the same time the milk wagons of other retailers are covering various portions of the same route, and so there is a great waste of effort and of expense in the distribution.

The division of States in which the cost of distributing milk from producer to consumer is the most is the North Central group, in which producers receive 44 per cent of the prices paid by the consumer. Next in order follow the Western States with 47 per cent, the North Atlantic States with 53 per cent, the South Central States with 55 per cent, and the South Atlantic States with 57 per cent.

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The average price paid by consumers in the 78 cities is almost exactly 8 cents per quart. In the North Atlantic and North Central States the average is 7.5 cents; in the Western States, 8.9 cents; in the South Central, 9.1 cents; and in the South Atlantic States, 9.3 cents. These prices are for the last week in June, 1910.

BUTTER AND THE RETAILER.

Factory butter was included in this investigation of prices, in the three classes of creamery print, creamery tub, and renovated. Consumer's prices were taken in 78 cities in all parts of the country and the facts were ascertained in the latter part of June, 1910.

In the distribution of creamery butter from factory to consumer the ultimate price includes the railway charge for transportation and the retailer's addition. The freight charge is about 0.6 of 1 per cent of the consumer's price.

As a general average for the 78 cities, the creamery receives 86.3 per cent of the consumer's price for creamery prints. The percentages are nearly the same in all geographic divisions, the lowest, 84.6 per cent, being found in the Western States, and the highest, 87.5 per cent, in the South Atlantic States.

In the case of creamery tub butter, the factories receive 86.5 per cent of the consumer's price in the 78 cities, the Western States again having the lowest percentage, 84.6 per cent. The highest percentage is 88 for the South Central States, and in the other divisions the percentage is between 86 and 87.

Factories that renovate butter receive a somewhat larger percentage of the consumer's price than in the case of creamery prints and tub butter. The average for the 78 cities is 88.3 per cent, with inconsiderable variations among the geographic divisions of the country.

EXHAUSTIVE INVESTIGATIONS.

The increase of price of farm products in their transfer from producer to consumer was thoroughly investigated in all parts of the country and for a large variety of products by the Industrial Commission. Although the facts obtained in that investigation are now about ten years old, it is believed that the ratios between producer's and consumer's prices are approximately the same now as they were then. At any rate, it seems probable that the farmer is not now receiving a larger share of the consumer's price than he received ten years ago, and he may be receiving a smaller share.

POULTRY.

Within the field of investigation it was found that poultry almost doubled in price between the farmer and the consumer; in other words, the farmer received only 55.1 per cent of the consumer's price.

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Inquiries were made concerning turkeys as distinct from other poultry, with the result that it was found that the farmers received 63.5 per cent of the final price. Chickens as a separate description are represented by the percentage of 68.4 when priced by the pound, and by 57.1 per cent when priced by the head.

Of the price per dozen paid by the consumer, the producer received 69 per cent in the case of eggs; dried beans, 75 per cent when bought by the bushel; cabbage, 48.1 per cent when bought by the head and 64.9 per cent when bought by the pound; cauliflower, 75 per cent when bought by the dozen; and celery, 60 per cent when bought by the bunch.

THE SMALLER THE RETAIL UNIT, THE LESS THE FARMER RECEIVES.

The general fact was that the producer's percentage of the consumer's price diminished as the quantity sold at retail was smaller. For instance, the apple grower received 55.6 per cent of the consumer's price when the consumer bought by the bushel and 66 per cent when the purchase was by the barrel. When the consumer bought corn by the bushel, the farmer got 70.6 per cent of the price, but when the purchase was by the barrel the farmer received 81 per cent. The strawberry grower received 48.9 per cent of the consumer's price in purchases by the quart and 75.9 per cent in purchases by the crate. A still better illustration is found in the case of onions. In purchasing a peck at a time, the farmer received 27.8 per cent of the retail price; in purchases of a barrel, he received 58.3 per cent; and in purchases by the 100 pounds, he received 69 per cent. So in the case of oranges, when the purchase was by the dozen the grower received 20.3 per cent of the consumer's price, whereas when the purchase was by the box the grower received 59.3 per cent.

FACTS FOR MANY PRODUCTS.

Farmers received 83.3 per cent of the final price in the retail purchase of blackberries by the crate, 75 per cent in the purchase of cucumbers by the third of a bushel, 66.7 per cent in the purchase of egg-plant by the crate, 60 per cent in the purchase of green peas by the quart, 70.5 per cent when hay was bought by the ton, and 82.2 per cent in the purchase of horses from retailers.

Among the many other products represented in this list are oats, with 73.6 per cent of the price going to the farmer when bought by the bushel; melons, 50 per cent when bought by the pound; parsnips, 60 per cent when bought by the bunch; potatoes, 59.3 per cent when bought by the bushel; string beans, 80 per cent when bought by the barrel; sweet potatoes, 60.8 per cent when bought by the barrel; turnips, 60 per cent in purchases by the bunch; watermelons, 33.5 per cent when bought singly.

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In some cases there were purchasers from the farmer who were middlemen. It was found that cotton growers received 93 per cent of the price paid by cotton manufacturers for the raw cotton; 84.1 per cent of the price of broom corn paid by the broom manufacturers; 80 per cent of the price of calves and 91 per cent of the price of cattle paid by packers; 93 per cent of the price of hogs and 74.2 per cent of the price of lambs paid by packers; 87 per cent of the price of tobacco paid by the hogshead and 92.2 per cent when bought by the pound by manufacturers; 72.9 per cent in the case of wheat bought by millers; and 91.7 per cent in the case of wool bought by manufacturers.

FREIGHT CHARGES.

To the foregoing percentages that represent the share of the farmer in the consumer's price should be added the percentage standing for the freight charge in determining the share of the consumer's price that goes to the middlemen. With approximate accuracy it has been determined that when the farmer received 50 per cent of the consumer's price, the freight charge on butter is about 0.5 of 1 per cent of the consumer's price; eggs, 0.6 of 1 per cent; apples, 6.8 per cent; beans, 2.4 per cent; potatoes, 7.4 per cent; grain of all sorts, 3.8 per cent; hay, 7.9 per cent; cattle and hogs, 1.2 per cent; live poultry, 2.2 per cent; wool, 0.3 of 1 per cent. The foregoing allowances for freight are to be increased by one-half when the farmer receives about three-fourths of the consumer's price.

COFFEE PRICES.

The import statistics of the Department of Commerce and Labor afford some striking comparisons between original value and consumer's price. In the fiscal year 1910 four-fifths of the coffee imported into the United States came from Brazil; 17 per cent from other countries in South and Central America and from Mexico, so that 97.2 per cent of the imports were from Mexico, Central and South America. About 0.1 of 1 per cent of the coffee imports are from Aden and are the nominal Mocha coffee, and 1.3 per cent of the imports are from the East Indies and are the Java coffee.

In 1910 the coffee imported from American countries, which was 97.2 per cent of all coffee imports, had an import value of 7.8 cents per pound. To this should be added the ocean freight rate. From Rio Janeiro the rate is 0.28 of 1 cent, or about one-fourth of a cent per pound. For nearly all of this American coffee the consumers paid prices ranging from 20 to 35 cents per pound. In other words, the import value, plus the ocean freight charge, is only from 23 to 40 per cent of the principal range of prices paid for the coffee at retail.

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PRICES PAID FOR TEA.

Tea may be referred to in the same way. In the fiscal year 1910 the average import value of tea was 16 cents per pound. It is assumed that nearly all of the tea consumed in this country is bought at retail prices ranging from 50 to 70 cents per pound and, with this understanding, the import value of tea is from 23 per cent to 32 per cent of what the consumer pays.

CONSUMER'S PRICE AS AN INCREASE OF FARMER'S PRICE.

PRICE GAINS FROM ANOTHER POINT OF VIEW.

In the consideration of this subject so far, the aspect has been that of the producer; the farmer thinks of the price that the consumer pays for farm products and compares with them the price that he himself receives.

While the farmer is looking forward with regard to the prices of his products, the consumer is looking backward, and so regards the prices that he pays as increases upon what the farmer gets. This aspect of the matter may now be worth some attention.

It is established by the investigation of this Department made last June that the milk consumers of 78 cities paid for milk an increase of 100.8 per cent above the price received by dairymen; in other words, the farmer's price was fully doubled. The lowest increase among the geographic divisions was 75.5 per cent in the South Atlantic States and the highest was 111.9 per cent in the Western States.

In the purchase of butter the consumer pays 15.8 per cent above the factory price in the case of creamery prints, 15.6 per cent above in the case of factory tub, and 13.3 per cent above the factory price in the case of renovated butter. The percentages of increase among the five divisions of States do not vary much from the averages for the United States.

Some large percentages of increase of prices were found by the Industrial Commission—135.3 per cent for cabbage bought by the head; 100 per cent for melons bought by the pound, for buttermilk sold by the quart, and for oranges sold by the crate; 260 per cent for onions bought by the peck; 400.4 per cent for oranges bought by the dozen; 111.1 per cent for strawberries bought by the quart; and 200 per cent for watermelons sold singly.

There were many cases of increase of consumer's price over farmer's price amounting to 75 per cent and over, but under 100 per cent, and among these were 90.5 per cent for apples bought by the barrel and 80.6 per cent for apples bought by the box; 75 per cent for chickens bought by the head; 83.4 per cent for onions bought by the pound; 80.5 per cent for potatoes bought by the bushel; 88.8 per cent for poultry in general bought by the pound; 95.8 per cent

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for strawberries bought by the box; 82.5 per cent for sweet potatoes bought by the bushel.

It may be worth while to extend the list of farm products that are sold to consumers at a large increase above farm prices. In the class of commodities selling for an increase of price amounting to 50 per cent and over but under 75 per cent above farm prices may be mentioned the following increases: 61.8 per cent for cabbage bought by the pound; 66.7 per cent for celery bought by the bunch, turnips and parsnips bought by the bunch, and green peas bought by the quart; 54.4 per cent for chickens bought by the pound; 50 per cent for eggplants bought by the crate; 68.4 per cent for onions bought by the bushel; 68.7 per cent for oranges bought by the box; 60 per cent for potatoes bought by the peck; 59.8 per cent for turkeys bought by the pound.

The import price of coffee in the fiscal year 1910, which was 8 cents a pound, after the increase to 20 and 35 cents per pound to the retailer, has risen in price to the consumer from 150 to 337.5 per cent. So with tea of the same fiscal year; its import price of 16 cents per pound, after being increased to 50 to 70 cents per pound, cost the consumer an advance of 212.5 to 337.5 per cent.

Before assigning to middlemen the various increases of prices, it is proper to deduct the percentages due to freight rates. The freight charge for milk received in New York is about 18 per cent of the producer's price and in Chicago about 14.7 per cent. Of the import price of coffee, the ocean freight charge from Rio Janeiro is 3.6 per cent. The percentages of farm price for which freight charges stand in the United States may be estimated at approximately 0.9 of 1 per cent of the factory price for butter; 1.2 per cent of the farm price for clover seed; 1.6 per cent for cotton; 1.3 per cent for eggs; 13.6 per cent for apples; 4.8 per cent for beans; 14.8 per cent for potatoes; and 5 per cent for sweet potatoes. The rates for oats, rye, barley, and wheat are nearly the same, ranging from 6 per cent for oats to 7.3 per cent for barley and rye. The rate for corn is 9.2 per cent and the average for all grain is 7.7 per cent. For hay the percentage is 15.8 per cent; for cattle and hogs, 2.5 per cent; for live poultry, 4.5 per cent; and for wool, 0.6 of 1 per cent.

NO GROUND FOR COMPLAINT AGAINST THE FARMER.

From the details that have been presented with regard to the increase of the prices of farm products between farmer and consumer, the conclusion is inevitable that the consumer has no well-grounded complaint against the farmer for the prices that he pays. The farmer supplies the capital for production and takes the risk of his losses; his crops are at the mercy of drought, and flood, and heat, and frost, to say nothing of noxious insects and blighting diseases. He supplies

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hard, exacting, unremitting labor. A degree and range of information and intelligence are demanded by agriculture which are hardly equaled in any other occupation. Then there is the risk of overproduction and disastrously low prices. From beginning to end the farmer must steer dextrously to escape perils to his profits and indeed to his capital on every hand. At last the products are started on their way to the consumer. The railroad, generally speaking, adds a percentage of increase to the farmer's prices that is not large. After delivery by the railroad the products are stored a short time, are measured into the various retail quantities, more or less small, and the dealers are rid of them as soon as possible. The dealers have risks that are practically small, except credit sales and such risks as grow out of their trying to do an amount of business which is small as compared with their number.

PROBLEM FOR CONSUMERS AND NOT FARMERS TO REMEDY.

After consideration of the elements of the matter, it is plain that the farmer is not getting an exorbitant price for his products, and that the cost of distribution from the time of delivery at destination by the railroad to delivery to the consumer is the feature of the problem of high prices which must present itself to the consumer for treatment.

Why do not consumers buy directly from the farmers? A distribution of farm products in this simple way has already begun in England, where cooperative organizations of farmers are selling by direct consignment to cooperative organizations of consumers in cities.

Farmers' cooperative selling associations are numerous in this country, but cooperative buying associations among the people of cities and towns are few. Aside from buying associations maintained by farmers, hardly any exist in this country. It is apparent, therefore, that the consumer has much to do to work out his own salvation with regard to the prices that he pays. Potatoes were selling last spring in some places where there had been overproduction for 20 cents and in some places for even 9 cents per bushel at the farm, while at the same time city consumers in the East were paying 50 to 75 cents per bushel, although there was nothing to prevent them from combining to buy a carload or more of potatoes directly from the grower and for delivery directly to themselves.

POPULATION, CROP YIELDS, AND PRICES.

PRODUCTION PER ACRE OVERTAKING INCREASE OF PEOPLE.

IMMIGRATION AND BIRTH RATE.

The population of the United States has increased rapidly in the past. Our doors have always stood open to immigrants from other lands. Our ancestors had large families. Our numbers have

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increased one-third every ten years until 1880, and afterwards one-fourth to one-fifth. Our expanding farm area has easily provided sustenance for our increasing numbers. But with the filling up of our unoccupied spaces some have begun to fear that in the near future we shall be unable to provide all our food from our own fields. Population increases; yields decrease (so it is said), and the time is at hand when we shall have to import foodstuffs; our economic independence will then be gone.

Immigration, however, is not to be counted upon permanently to furnish any considerable annual increase in our numbers. Three-fourths of a million may enter our ports in one year; but the very next year may see a financial depression, with the tide of emigration setting away from our shores. Only the birth rate may be counted upon as a permanent force acting toward increasing the population; and the increase of the native-born population by excess of births over deaths in this country is only about 1¼ per cent a year, with a tendency toward a decreasing birth rate.

The great question, then, is this: Are the products of our agricultural lands increasing or decreasing in quantity? Is the yield per acre of our fields keeping pace with this normal increase of population by births? To the latter question the answer is that the process has begun.

RISING YIELDS PER ACRE.

Dividing the period from 1866 to 1909 into four decades and a succeeding short period of four years, the yield per acre of corn is shown by a study made in the Bureau of Statistics to have declined 2.3 per cent from the first decade to the second, declined 8.2 per cent from the second to the third, increased 7.7 per cent from the third to the fourth, and increased 7.1 per cent from the fourth decade to the succeeding four-year period.

For wheat an even better showing is made, since the figures show a continuous increase in yield per acre, namely, 3.4 per cent from first decade to second, 3.3 from second to third, 6.3 from third to fourth, and 9.6 from fourth decade to final four-year period.

For cotton, the first figure, 2.8, is a decline, but the rest are increases, namely, 2.6, 3.8, and 0.3.

For tobacco, the first figure, 3.4, is an increase, the second, 2.0, is a decline, the third, 5.2, is an increase, and so also is the last, 9.7.

Similar facts are shown for six other leading crops, namely, oats, barley, rye, buckwheat, hay, and potatoes. Not one of the ten crops named declined in yield per acre from the third decade to the fourth, while oats was the only one to show a decline from the fourth decade to the last period of four years. The evidence is very plain that the yields per acre of our crops are now increasing, and if the

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facts were assembled in detail for the States, it would be found that the percentage of increase in yield in many of them is greater than the percentage of normal increase in population; that is, the increase by births over deaths in the old native element.

Such is the fact with regard to wheat for the fourth decade, as compared with the preceding one, in 26 States, and 2 of the States are all but ready to join them. In 14 States corn production per acre has increased faster than the normal increase of population and this is almost true of 5 more States. The number of States in this list in the case of barley is 21; rye, 30; buckwheat, 19; cotton, 3; potatoes, 24; hay, 35; and more or less States are almost ready to enter this list in the case of all crops.

A demand that is more difficult to fulfill in production per acre is for an increase that equals or exceeds the actual increase of population, including the immigrants and the temporarily high birth rate of the foreign born. But, notwithstanding the fact that this difficulty is greater in the United States than it is in all other countries that have practically ceased to take much new land into cultivation, many of the States of this Nation are each maintaining an increase of production in the case of one or more prominent crops that is greater than the actual increase of population. Ten States are doing this in the case of corn; for wheat the number is 22; for oats, 16; for cotton and tobacco, 1 each; for rye, 21; for potatoes, 15; and for hay, 25.

We can not look for any other result than that the yields per acre of all our crops shall increase at an even faster rate in the future, in view of the intense interest with which our people are turning their attention toward agricultural improvement. If there are certain forces at work which, if unchecked and made more prevalent, will in the future compel us to bid against the world for food, the counteracting forces have nevertheless been already set in motion, with the promise of increasing effect.

INCOME PER ACRE.

The farmer has benefited more than others from the changed conditions which have manifested themselves in increased cost of living. For instance, the product of 1 acre of corn in 1899 was worth on the farm $8.51, but ten years later it was worth $15.20, an increase in farm value amounting to 78.6 per cent. Similarly, wheat increased in farm value 114 per cent, tobacco 56.2 per cent, and cotton 65.6 per cent. Ten leading crops taken together—including, besides those mentioned, oats, barley, rye, buckwheat, potatoes, and hay—increased 72.7 per cent in farm value.

This, of course, is no advantage to the farmer if the increase in price of the things he has to buy is still greater. To ascertain the

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facts in this matter, the Bureau of Statistics sent a letter to a large number of retail dealers doing business with farmers. These dealers were asked to quote the prices which prevailed in 1899 and in 1909, taking care to compare articles of the same grades. In this way the percentage of increase in the prices of about 85 articles commonly used by farmers was determined.

In three cases the prices were less in 1909 than in 1899; in four cases they were the same; but in all other cases they had increased, the increases running from 2.7 per cent in the case of manure spreaders and mowers to 53.8 per cent in the case of brooms. Coffee increased 9.8 per cent; flour, 32.4; salt, 14.9; sugar, 8.7; overalls, 22.9; rubber boots, 29; calico, 26.9; muslin, 25; and so on. For all the articles considered the average increase was 12.1 per cent.

Now, compare this with the 72.7 per cent increase in the farm value of the ten leading crops. The farmer has evidently benefited more than the rest of the community—taken all together—from the changes in values.

Put the facts in another way. The produce of 1 acre of corn was equal in value to 1.8 barrels of flour in 1899, but to 2.4 barrels in 1909. Or, it would buy 118.2 yards of muslin in 1899 and 168.9 yards in 1909. The average purchasing power of all crops similarly increased from 2 barrels of flour in 1899 to 2.6 barrels in 1909, and from 132.1 yards of muslin in 1899 to 182.4 yards in 1909. And so with the whole list of articles used by farmers.

The facts may also be put in the form of percentages by letting 100 represent the purchasing power of 1 acre of farm crops in 1899. Then, in 1909 the purchasing power of 1 acre of corn is seen to have increased 90 per cent when spent for coal oil, 62 for coffee, 33 for flour, and 64 for sugar. Now, take the average purchasing power of all crops. It increased 83 per cent when spent for coal oil, 57 for coffee, 30 for flour, 59 for sugar, and so on down the list. Taking the average of all articles, corn increased 60 per cent in purchasing power, wheat 91, and cotton 48, while the grand average increase in purchasing power of all crops is 54 per cent. In other words, the farmer has received a 54 per cent benefit from the changed conditions.

No one can pretend to understand all the forces at work in these matters. Possibly the farmer's present advantage is due, in part, to temporary conditions of supply and demand that may change to his disadvantage. If it is also due in part to a greater appreciation of the value of the farmer's work, that, too, is something upon which no calculations can be based.

But there is no sort of doubt that a great part of the farmer's prosperity rests upon the bed rock of a greater output, a higher yield per acre. That is to say, farmers and farming have become

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more efficient, not only to the benefit of the farmer himself, but also to the safeguarding of our National independence. The wisdom of Congress in aiding agriculture in the past, through the Federal Department and the state colleges and experiment stations, as well as the advisability of giving even greater fostering attention in the future to our most fundamental industry, is thus made plainly manifest.

PROPOSED DEPARTMENT OR BUREAU OF PUBLIC HEALTH.

Within the last few years there has been developing a strong sentiment in favor of the Government making larger provision for the promotion and protection of human health, and at the last session of Congress several bills providing for the establishment of a Department or Bureau of Public Health were introduced. Although I am in hearty accord with the general object of providing better facilities for work in the interest of the public health, I find that most of the particular plans which are being urged upon Congress and which are represented by some of the bills referred to would probably have a disastrous effect upon a large part of the important work being carried on by the Department of Agriculture.

The bill which has been most widely indorsed and actively pressed provides for the creation of a new Executive Department to be known as the Department of Public Health, and for the transfer to that Department of "all departments and bureaus belonging to any department, excepting the Department of War and the Department of the Navy, affecting the medical, surgical, biological, or sanitary service, or any questions relative thereto," and for the transfer specifically of the Bureaus of Entomology, Chemistry, and Animal Industry of the Department of Agriculture. The effect of the language above quoted, if fully carried out, would be to transfer the Department's biological work relating to plant life, such as is carried on by the Bureau of Plant Industry and the Forest Service. Other bills introduced in Congress provide for a Bureau of Public Health and for the transfer to that Bureau of only certain portions of the work above mentioned.

It can readily be seen that the effect of the bill first mentioned, which is being seriously pressed upon the attention of Congress, would be to disintegrate the Department of Agriculture and to take away from it work which it properly performs and which clearly has no logical place in a Department or Bureau of Public Health. Even though some of the more unreasonable features should be dropped, it is seriously proposed to place in the Department or Bureau of Public Health the work relating to the enforcement of the Food and Drugs Act now carried on by the Bureau of Chemistry, and

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the meat inspection and veterinary service of the Bureau of Animal Industry.

To remove from the Department of Agriculture the meat-inspection and veterinary work would, I believe, be a great detriment to the work of this Department and to the agricultural and live-stock interests, without any corresponding gain in efficiency or advantage to the public, and would result in increased expenditures rather than in economy.

The most important function of the Department of Agriculture is to study means for providing a sufficient and wholesome supply of food for the people of the country. With the rapidly growing population, without any corresponding increase in the area of land, and with the increasing prices of the necessaries of life, it becomes more essential that the Department should aid in the development and introduction of methods of agriculture which will increase and conserve the supply of food. This work relates not only to the production of field corps but to the breeding and raising of animals. The production of meat and dairy animals involves not only problems of breeding, feeding, and handling, but also those of studying, preventing, curing, and eradicating animal diseases. It would be utterly impracticable to separate the work relating to diseases from that relating strictly to animal husbandry. These various subjects are parts of a single great problem which is primarily agricultural, notwithstanding its relation to human health.

With regard to the meat inspection, experience in this and other countries has shown that this work can best be done by and under the direction of veterinarians. In the work of the Department of Agriculture it has been found that some of the same men can be utilized at different seasons of the year in meat inspection and also in other work. For example, the field work for the eradication of diseases of animals is carried on mostly during the summer, while the work of slaughterhouses is heaviest during the winter; and it is thus found to be practicable and economical to shift men from one to another of these branches as the needs of the service require.

If any of these lines of work were transferred from the Department of Agriculture to the proposed Department or Bureau of Public Health, the work of the former Department would be seriously crippled, and in order for this Department to continue its work efficiently it would have to replace a large part of the organization so transferred. This would inevitably result in a duplication of work and expenditure, instead of the supposed economy which is one of the arguments given in favor of such a transfer.

I can not see that it is at all essential to an efficient public health organization that there should be included in such organization work which more properly belongs in the Department of Agriculture, or

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that the Department of Agriculture should be disintegrated in the manner proposed. There seems to be an ample field for public health activities without encroaching upon the field of agriculture and without taking away work which is already being satisfactorily performed by the Department of Agriculture, and which, in my judgment, it can perform better and more economically than any other agency.

ENFORCEMENT OF THE FOOD AND DRUGS ACT.

The Food and Drugs Act operates in two ways: First, it deals with food and drugs which are shipped into interstate commerce or which are manufactured or offered for sale in the District of Columbia or the Territories; second, it prevents adulterated and misbranded foods and drugs from entering the country.

During the fiscal year 1910, 990 interstate cases based upon the Food and Drugs Act of June 30, 1906, were reported to the Attorney-General, 766 cases as the basis for criminal action, and 224 cases as the basis for seizure proceedings. Of the 766 criminal cases, 246 resulted in convictions. Verdicts for the defendants were rendered in 3 cases; 96 cases were dismissed on the recommendation or with the concurrence of the Attorney-General or the United States attorney in charge; 152 cases were pending in the courts at the close of the year, while 252 cases remained in the hands of the Attorney-General or the United States attorneys for consideration and presentation to the courts. In no case was leniency shown in cases involving foods unfit for consumption or deleterious to health, or involving drugs containing dangerous and habit-forming ingredients. Fines were collected in the sum of $7,858 in cases reported during the year. In addition, 60 criminal cases reported in previous years terminated, fines being assessed in the sum of $2,701.31, making the total of fines collected under this act during the year $11,049.31. Of the 224 seizures of adulterated and misbranded foods and drugs, 132 resulted in decrees of condemnation and forfeiture, while 50 cases were pending at the close of the year. In addition, 43 shipments were forfeited under seizures effected during the previous fiscal years.

Twenty-one of the ports of entry in the United States are provided with well-equipped laboratories, and during the past year there has been great activity in examining foods and drugs to prevent any misbranded or adulterated ones from being put on the American market. During the past year 95,482 samples were examined. Of this number, approximately 3,000 were found to be illegal and were either altogether refused admittance to the country or else admitted only after they had been properly branded or the objectionable features removed or obliterated. Of the grand total above given, 5,130 samples were submitted to careful examination in the laboratory, the remainder to

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inspection as the products were opened by the appraisers for the assessment of duties.

That the result of this inspection at the ports has resulted in an improved quality in many instances is shown, for example, by the change in the character of the fig imports now offered for entry. In the report for last year attention was directed to this article of food. The figs now offered for the use of the people are cleaner and better than they were last year.

Several years ago a great many detentions were made at the port of New York of lemon oil sophisticated with pinene. The character of the oil offered for entry during the past year has been practically free from all objectionable features. Very few cases are met with now where objectionable preservatives have been used. The coloring matter used in foods is practically confined to the list of aniline dyes mentioned in Food Inspection Decision 76.

WORK OF THE DEPARTMENT IN 1910.

OFFICE OF THE SOLICITOR.

Since June 30, 1909, the work of this Office has more than doubled. There were reported to the Attorney-General in the past fiscal year, through this Office, in all, 1,738 cases arising under the acts of Congress administered by the Department of Agriculture, being twice as many cases as were similarly reported in the fiscal year 1909. As a result of these reports between $40,000 and $50,000 in fines and costs was assessed against defendants; hundreds of tons of adulterated or misbranded foods and drugs were forfeited, and many cases of claims to lands lying within the National Forests were adjudicated. In addition a large number of permits for the use of the resources of the National Forests were scrutinized; 350 contracts, leases, and bonds were prepared, and the sufficiency of the execution of the same later examined; letters patent on inventions made by the employees of the Department and for dedication to the public were secured; the entire Office, both in the field and in Washington, was reorganized, and the force in Washington assembled under one roof. Nearly 100 written opinions were rendered to the Secretary and the various chiefs of Bureaus on the interpretation of the acts of Congress applicable to the Department, or on legal questions arising in the conduct of the business of this Department; close touch was kept with all the Department's cases in the hands of United States attorneys, memoranda as a basis for briefs were prepared for their use, and, in general, the cooperation between the officers of the Department of Justice and this Office was complete and cordial. The cases arising under the acts of Congress administered by the Department

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of Agriculture are extremely varied in character; they include criminal actions for trespasses on National Forests, prosecutions of manufacturers and dealers who ship or sell adulterated and misbranded foods or drugs, prosecutions of persons who ship uninspected meats in interstate commerce, prosecutions against railroad companies for transporting live stock out of areas quarantined for disease, actions against carriers for detaining live stock without feed, water, or rest in transit for more than twenty-eight hours, prosecutions for the interstate shipment of game killed in violation of state game laws, civil actions for the seizure of adulterated or misbranded foods and drugs, and suits for damages for injuries to the National Forests.

Important decisions upon questions arising in such cases have been handed down by the United States district and circuit courts and circuit courts of appeals. At the close of the fiscal year 1910 five cases in which this Department is directly interested were on the docket of the Supreme Court of the United States. Many of these cases have attracted considerable attention throughout the country, notably United States *v.* Grimaud, involving the validity and effect of the regulations made by the Secretary of Agriculture regarding the National Forests; United States *v.* Baltimore & Ohio Southwestern Railroad Company, involving the unit of violation under the Twenty-eight Hour Law; United States *v.* Johnson, involving the question whether the Food and Drugs Act applies to alleged false claims as to curative properties of proprietary medicines, and United States *v.* Pittsburg Melting Company, involving the constitutionality of the Meat-Inspection Law.

The agricultural appropriation act of May 26, 1910, contains the following provision: "Hereafter the legal work of the Department of Agriculture shall be performed under the supervision and direction of the Solicitor." This was, in effect, simply a recognition by Congress of the position of the Solicitor since the office was created, on June 17, 1905, by General Order No. 85, as legal adviser to the Secretary of Agriculture. Pursuant to this provision, General Order No. 140 was issued, effective July 1, 1910, supplementing General Orders Nos. 85 and 138, and outlining the work to be performed by the Solicitor on behalf of the various Bureaus, Offices, and Divisions of this Department. By General Order No. 138 the legal work of the Forest Service was placed under the immediate supervision of the Solicitor; theretofore, while handled in general under his direction, this work was in the immediate charge of the law officer of the Forest Service. That office has now been abolished.

Since January 15, 1910, therefore, the law work of the Forest Service has been under the immediate direction of the Solicitor. Since that date 105 cases of apparent violations of the acts passed for the protection of National Forests were reported to the Attorney-General for

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appropriate action; 51 written opinions were rendered to officers of the Forest Service on the legal phases of questions arising in the administration of the National Forests; 53 agreements, 150 leases, and 47 bonds were prepared during the same period on behalf of the Forest Service; 565 cases of contested claims to lands within the National Forests initiated under the public land laws, including the homestead and mining laws, were disposed of during the same period by the branches of this Office in the field.

Under the Twenty-eight Hour Law 438 cases were reported to the Attorney-General; in the 139 cases closed during the fiscal year 1910 penalties aggregating $16,500 were recovered, and costs to the amount of $2,919.35 were paid; 19 cases out of 158 tried resulted in favor of the defendants; 29 cases were dismissed for insufficiency of evidence; 559 cases were pending at the close of the year. Experience in the administration of the Twenty-eight Hour Law during the past year does not disclose any considerable improvement in the methods of handling live stock in transit, since more than twice as many instances of apparent violations of this statute were reported as during the preceding year. To carry out the present intent of Congress in passing the act, which was framed to secure the humane handling of live stock in transit, it would seem that an additional provision should be incorporated therein requiring carriers to maintain a reasonable minimum speed on all stock trains. One hundred and forty-eight apparent violations of the live-stock quarantine laws were reported to the Attorney-General during the year; fines in the sum of $2,970 were collected in the 20 cases disposed of during the fiscal year 1910. Fifty-two violations of the Meat-Inspection Law of June 30, 1906, were reported to the Attorney-General during the year; of these, 18 resulted in conviction, 8 were dismissed because of the insufficiency of the evidence, and 26 are pending in the courts. Two cases were reported to the Attorney-General under the Lacey Act regarding the interstate transportation of game killed in violation of state laws. One case is pending and the other was abandoned because of the apparent impossibility of proving the interstate shipment. Four cases coming over from the previous year were disposed of; in two the grand jury failed to return an indictment; in the other two cases fines were assessed.

An important decision was handed down by the Circuit Court of Appeals of the Eighth Circuit toward the close of the year, sustaining the constitutionality of the Lacey Act and the power of Congress to require that interstate shipments of game be plainly marked so as to show their contents. A detailed statement of all the cases reported or tried under the various acts of Congress administered by this Department, together with a full description of the work of this Office during the past fiscal year, will be found in the report of the Solicitor.

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The work of the Office of the Solicitor in connection with the Food and Drugs Act is discussed under the heading "Enforcement of the Food and Drugs Act.

CHANGES IN THE PERSONNEL.

The total force of officers and employees on the rolls of the Department July 1, 1910, as shown by the report of the Appointment Clerk, numbered 12,480, an increase of 1,340 for the fiscal year. The force employed in Washington numbered 2,414 and 10,066 were employed outside of Washington. During the year 34,267 appointments of every description were made, including 22,622 persons appointed in the forests and fields and on stations in the various States in the manual-labor grades for very short periods, generally three months, or in other grades for six months or less. The number of persons receiving probationary appointments, equivalent to absolute appointment if retained in the service after the probationary period, was 1,088. There were reinstated 56, and transferred from other Departments 67. During the year there were 681 resignations from the service, 61 died while in the service of the Department, and 75 were dismissed for the good of the service because of their misconduct. On July 1, 1910, there were 1,420 officers and employees on the statutory roll (positions specially provided for by Act of Congress making appropriations for the Department), and 11,060 were paid from lump-sum appropriations. The large number of emergency appointments is made necessary by the varied experiments, demonstrations, meat and food inspection, work on the National Forests, extinction of injurious insects, etc., where temporary help is required, some of which was employed on July 1, 1910, making the apparent increase in the Department's employees greater than the actual.

WEATHER BUREAU.

The operations of the Weather Bureau during the past year have been marked by an enlargement of its service to the general public. There has been a normal increase in the volume of its routine business, while, at the same time, the prosecution of its work along lines of scientific research has made encouraging progress. There has also been increased activity in special investigations of the relations of meteorology and climatology to the flow of water in streams, to irrigation and reclamation projects, and to problems of forest and plant growth, all of which are at present engaging the attention of the country to an unusual extent, especially in portions of the West.

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RESEARCH WORK.

The exploration of the upper atmosphere by means of kites and balloons has been continued at the Mount Weather Research Observatory, with satisfactory results. There were only nine days during the year on which ascents were impracticable. The record of heights reached shows that the majority of flights did not reach above 10,000 to 13,000 feet, only about 17 per cent of the total number exceeding that elevation. On days when kites and captive balloons can not be sent up, on account of unfavorable weather conditions, small balloons are liberated, either singly or in tandem. Their first simultaneous use in this country was made by members of the Mount Weather Observatory in September and October, 1909, field parties having gone to Fort Omaha, Nebr., and Indianapolis, Ind., for that purpose, while a second expedition continued the experiments at Fort Omaha in May, 1910. Of the instruments sent up in these small balloons, 12 out of 13 sent up from Fort Omaha and 6 out of 7 sent up from Indianapolis were recovered after the first trip, while 15 out of 20 were secured after the second trip.

The main difficulty met with in attempting to make satisfactory scientific deductions from the flights is due to the varying heights reached and to the differing weather conditions under which they are made, it being obvious that a direct comparison of atmospheric conditions, one day with another, is not possible, unless daily records are obtained from approximately the same levels. Notwithstanding this the work of aerial research has already disclosed a number of new and important facts, of which the following may be enumerated:

It has been found, for example, that the stratification of the atmosphere as regards temperature and moisture is far more extensive than was suspected. The accepted rule of decrease in temperature with increase in altitude has many exceptions, a great layer of warm air being frequently found floating upon a layer of cold air, while the thickness and horizontal extent of such warm masses have been found to vary greatly. Again, temperature inversions have been recorded by instruments at the time of ascent, whereas no trace remains when the kite is brought down again a few hours later. Likewise the depth of a given air mass changes with its onward movement past the line of ascent and the wind direction varies with different levels; sometimes when the surface wind is from the south, the direction half a mile upward may at the same moment be from the southwest and half a mile above that level it may be from the west. Cloud movements indicate that in this hemisphere the wind direction changes to the right with increasing altitude, but kite and balloon observations show that it is also deflected to the left at times. It has also

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been found that the depth of easterly winds is much less on this continent than over Europe. The observations also seem to show that temperature changes at the surface of the earth and at altitudes of 1 to 2 miles occur simultaneously, thus contradicting previous statements that the changes at relatively high levels foreshadow those for low levels twenty-four hours later. It has further developed that the temperature gradients for heat thunderstorms do not accord with those called for by theory. Similarly in hot waves the unusually high temperatures appear to be confined to the strata within half a mile of the earth's surface, while the heat wave does not advance abruptly with a solid front like a wall, but is built up gradually over the affected region.

Studies of atmospheric electricity and magnetism have been continued along the lines heretofore pursued, while the measurements of the intensity of solar radiation and the percentage of polarization of sky light have been made at Mount Weather and Washington as in previous years. The solar radiation records during the five years of observation show marked departures from the monthly and annual mean rates, just as similar records at European observatories during the past twenty-six years also show marked fluctuations in this respect. This study will be further pursued during the coming year at four or five additional stations, so located as to be fairly representative of the different climatological sections of the country.

Progress has been made toward installing apparatus for the study of the quantity of vapor in the atmosphere, and the investigation of the properties of different bodies as radiators and as absorbers of radiation. The question of the quantity of water vapor in the atmosphere is of sufficient importance to justify attempts to determine it, although the amount next the earth's surface is so strongly affected by purely local conditions that its consideration in weather forecasting has long since been abandoned.

Articles discussing the theoretical as well as the practical application of the data obtained at Mount Weather and other points appeared in the quarterly bulletin of the Observatory during the year. While devoted principally to the work at the Observatory, the columns of the bulletin are open to contributions from scientists engaged in corresponding lines of research anywhere in the world.

FORECASTS AND WARNINGS.

The application of the Mount Weather investigations to practical forecasting at Washington continued during the year, and has proved of material aid in increasing the accuracy and range of the forecasts. A few examples of possibilities in this way will serve to illustrate.

Sometimes a storm passes eastward without being followed by expected clearing weather, because a second storm was developing

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off the middle or south Atlantic coast. This new development is not indicated by surface observations, but the Mount Weather flights show north winds at high altitudes in advance of such formation. Again, when an atmospheric depression is approaching from the southwest, and the kite records show winds turning to the right with ascent, the usual warming up in the Atlantic States is retarded about twenty-four hours. Likewise, the turning of the winds to the left with ascent shows the depth of the cold northwest wind, from which inferences may be drawn as to the probable fall in temperature at the surface of the earth within the ensuing twenty-four hours. The thickness of the advancing stratum from the west or northwest also furnishes a clue to subsequent temperatures; when shallow, the cold is neither severe nor prolonged; but when the stratum is thick, and abnormally low temperatures are reported aloft, the cold will be of marked intensity and will prevail several days.

The hurricane season of the year was marked by a number of severe tropical disturbances, but in every instance warnings to shipping and other interests were given sufficiently in advance to enable them to take all necessary precautions. These storms comprise the Galveston hurricane of July 21, 1909, the hurricane that struck the coast near the mouth of the Rio Grande on August 27, 1909, the tropical storm that reached the Louisiana coast on September 21, 1909, and the Key West hurricane of October 11, 1909. That none was attended by loss of life is freely attributed by the press and public to the ample advance warnings of the Bureau. A somewhat extended account of the Key West hurricane appeared in my last report, in which it was shown that the special efforts of the Bureau were successfully directed to warning workmen engaged in the extension of the Florida East Coast Railroad, and that about 3,000 employees were withdrawn from dangerous points as a result of timely advices.

The cooperation of steamship lines has been requested during the coming year as an aid to the forecaster in predicting the direction of movement and the intensity of hurricanes in southern waters, through the receipt of wireless reports from vessels that may encounter conditions indicating the presence of a hurricane in their neighborhood. A circular was also issued to storm-warning distributing centers on the Atlantic and Gulf coasts, having for its object a revival of interest in the Bureau's system of furnishing hurricane warnings to people living in districts where unusually high tides would likely cause loss of life and property.

Forecasts for extended periods were made from time to time, as justified by general weather conditions, and since the latter part of March, 1910, regular weekly forecasts for the United States, together with a general résumé of the weather for the northern hemisphere, have been issued. Gratifying success has been experienced in the

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verification of these forecasts, especially when they betokened the breaking up of continued drought or the approach of cold waves or heavy snows.

The distribution of the information contained in the Bureau's forecasts and warnings has been effected, as in previous years, by telephone, telegraph, and mail, and through the press. The requests for additional weather reports by telegraph from the various observing stations were unusually numerous, exceeding those for any single year in the previous history of the Bureau. While public requirements in this respect have been met as far as possible by a reorganization of the Bureau's system of "circuit" reports, the demands were more than could be satisfied with the present fund available for telegraphic expenses.

RIVERS AND FLOODS.

The great floods of the year were those in the Missouri and its tributaries east of Kansas City, and in the Mississippi from Hannibal, Mo., to Chester, Ill., in July; in the North Pacific States in November and December; and in Utah and southern California in January, the last being one of those rare occurrences known as a "desert flood." The total loss was about $14,000,000, all of which was unavoidable. During the July floods about 1,000,000 acres of farm land, two-thirds of which was under cultivation, were overflowed, and the crop loss alone amounted to $5,500,000. The warnings issued during this flood saved property to the value of $1,000,000.

An extension of the river service has been made in the watershed of the Saginaw River, in Michigan, during the year. The river district of Hannibal, Mo., was also created, by assigning to it that portion of the St. Louis district between Hannibal and the mouth of Des Moines River. There is need of further extension of direct flood work, but other projects during the coming year will consume all available funds. The study of the Ohio River was continued, while schemes for the Cumberland and Tennessee rivers are well advanced. It is hoped that the entire scheme for the Ohio watershed will be completed during the coming year.

It was recognized more than a year ago that the approaching completion of irrigation projects in the far West had imposed new responsibilities on the Weather Bureau in the way of obtaining accurate snowfall measurements at the sources of water supply, the determination of the water equivalent of the accumulated snows of winter, and the gauging of the streams for the benefit of the water users. The prosecution of these inquiries has been intrusted to the River and Flood Division, and a series of observations along definite lines has already been planned.

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EVAPORATION STUDIES.

Studies of evaporation were continued at the Salton Sea, and a summary of the observations is being prepared. The problem of the rate of evaporation has been a difficult one to solve. The rates differ greatly for different points on or near the water and under different conditions of wind movement and elevation. The records of the Geological Survey show that the sea has been falling at the rate of about 55 inches annually for the past three years. The coefficients of evaporation deduced by the Weather Bureau from its experiments indicate an annual evaporation from the surface of about 70 inches. As the annual water inflow is thought to be about 15 inches, it will be seen that the results arrived at experimentally by the Bureau are in close accord with the observed general facts at that point, and, furthermore, that the coefficients established will probably be equally applicable to conditions of evaporation anywhere.

NEW APPARATUS.

Observations were made during the winter of 1909–10 with various forms of snow gauges suited for installation in the mountain districts of the West, whereby an accurate catch could be obtained and also be preserved for measurement at extended intervals. Further experiments will doubtless soon develop the best form of apparatus. New methods of measuring the intensity of solar radiation in absolute units of heat, by the use of the electrical resistance thermometer, were perfected during the year, and detailed drawings of a seismograph adapted to record very destructive earthquakes was supplied to the University of California by the Bureau.

It appears proper at this point to renew a former recommendation that Congress be requested to authorize and provide for seismological work, and to place it under the control of the Weather Bureau, which is already prepared through its widely distributed corps of regular and cooperative observers to collect and study earthquake observations. That the Bureau is prepared to conduct this work in an effective manner and at far less expense than any other department of the Government has already been recognized by the Seismological Committee of the American Association for the Advancement of Science, which, at its meeting in Washington in 1907, voted that the Federal Government be requested to support seismological work, and that the appropriations therefor be made through the Weather Bureau.

MARINE WORK.

The Marine Division continued to prepare and publish pilot and meteorological charts for the oceans, and will shortly begin the issue of a meteorological chart for the Great Lakes. A duplicate of the

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information collected by the Weather Bureau from cooperating vessels is furnished to the Hydrographic Office of the Navy Department, the information thus furnished constituting an important part of the Pilot Chart published by that Office. The Marine Division also has charge of the wireless telegraph and vessel-reporting services of the Bureau; these services have been conducted to the satisfaction of marine exchanges and other similar associations during the year.

PUBLICATIONS.

Certain changes in the manner of issuing publications were made during the year with a view to better serving the public needs. Of these, the most important was the policy adopted of discontinuing station weather maps wherever the newspapers would undertake their publication. Although the plan has been operative only four months, the "commercial weather map," as it is called, is now being published in 65 morning and evening papers in 45 cities, while 55 additional stations will introduce the method as soon as suitable outfits can be supplied. As a result of the change, the weather chart is now placed twice daily before millions of people, instead of thousands as heretofore, while the saving to the Bureau by discontinuing printing work will enable extensions of service along other lines.

BUREAU OF ANIMAL INDUSTRY.

The Bureau of Animal Industry has charge of the work of the Department relating to the live-stock industry. It conducts the inspection of live stock, meat, and meat food products intended for interstate or foreign commerce, under the act of Congress of June 30, 1906, and also has charge of the inspection of import and export animals and the quarantine stations for imported animals. It makes investigations in the breeding and feeding of live stock and in regard to the dairy industry. It also carries on scientific investigations as to the nature, cause, and prevention of communicable diseases of live stock and takes measures for their control and eradication, frequently in cooperation with state and territorial authorities.

MEAT INSPECTION.

The meat inspection has reached such proportions that it is only by strict economy that the Department is able to carry on this work within the standing annual appropriation of $3,000,000. During the past fiscal year the cost of this inspection was about $2,940,000. The inspection was conducted at 919 establishments in 237 cities and towns, an increase of 43 establishments and a decrease of 3 cities and towns as compared with the preceding year. There were inspected before slaughter 49,307,672 animals, consisting of 7,999,547 cattle, 2,295,800 calves, 27,731,627 hogs, 11,164,635 sheep, and 116,063

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goats. The animals inspected at the time of and after slaughter numbered 49,179,057, of which 7,962,189 were cattle, 2,295,099 calves, 27,656,021 hogs, 11,149,937 sheep, and 115,811 goats. Owing to a marked shortage in the supply of hogs there was a decrease of nearly 8,000,000 in the number slaughtered under inspection as compared with the previous fiscal year, although there was an increase in the number of all other species.

There were condemned because of disease or other condition 113,742 entire carcasses and 874,211 parts of carcasses, making a total of nearly 1,000,000 animals condemned in whole or in part, or about 2 per cent of the total number inspected. Tuberculosis was the cause of over 46 per cent of the condemnations among cattle and over 96 per cent of those among hogs.

Nearly six and a quarter billion pounds of meat food products of various kinds were prepared under the supervision of the government inspectors, and there were condemned on reinspection over 19,000,000 pounds of these products which had become unwholesome since inspection at the time of slaughter. The steady decrease in condemnations of this class indicates a corresponding improvement in sanitary conditions and in the methods of handling meat products in the packing houses.

The Department continues to maintain the closest vigilance over its meat-inspection service in order to guard against inefficiency or corruption on the part of any of the members of its force and against fraudulent practices on the part of the management of the inspected establishments. It is gratifying that, so far as known, there have been no serious shortcomings during the past year. Not only does the Department force show a high degree of integrity and efficiency, but the proprietors of the inspected establishments as a rule are entirely disposed to comply with the regulations and give cordial cooperation in the work of inspection. The regulations are based upon long experience and upon the best scientific knowledge not only of the Department staff but of outside experts, and an honest effort is made to enforce these regulations. It can be said without question that Government inspected meat merits the full confidence of the public.

The greatest source of danger with regard to the meat supply of the country comes from the meat which is not subject to inspection. The Government inspection is applied only to such meats as are produced by persons or establishments doing interstate or export business, and covers but a little more than half of the country's meat supply. The remainder must be looked after by state and municipal authorities, and it is gratifying that there is a general awakening to the need for local inspection. Inspection is already being carried on by many cities and a few States, and in other places steps are being

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taken to establish an efficient inspection system. The Department stands ready to give such aid and cooperation as it properly can.

ANIMAL HUSBANDRY.

In recognition of the growing importance of the work carried on by the Bureau of Animal Industry in the breeding and feeding of live stock the Animal Husbandry Office of that Bureau was designated as the Animal Husbandry Division, beginning with January 1, 1910.

Some promising animals are being obtained in the breeding experiments with carriage horses in Colorado and Morgan horses in Vermont. The wisdom of the purchases previously made of breeding animals has been demonstrated, and some additional purchases were made during the year. The young stock is passed on at intervals by a board of survey to determine what animals should be retained for the breeding experiments and what should be disposed of. At the close of the fiscal year there were 71 animals in the Colorado stud and 30 in the Vermont stud. Experiments in breeding range sheep in Wyoming are being continued with the object of improving the quality and type of this class of sheep. Good results are being obtained in experiments in breeding Holstein cattle in North Dakota and in developing a milking strain of Shorthorn cattle in Minnesota.

In the breeding experiments at the Bureau's experiment station at Bethesda, Md., several additional zebra-ass hybrids have been obtained. These are beautiful clean-limbed animals, and those now in their second year are considerably larger than their dams, although not as large as their sire. Extensive experiments in the breeding of small animals for the purpose of studying inbreeding, heredity, and similar problems have been continued.

Investigations in beef production in Alabama which have been in progress for six years indicate that with the eradication of the cattle ticks this may be made a profitable business in the South, and that in future the South may become the source of an important part of the beef supply of the country. The profits in feeding several experimental lots of steers ranged from $6.99 to $10.64 per head.

POULTRY AND EGG INVESTIGATIONS.

The cooperative experiments in poultry breeding and selection at the Maine Agricultural Experiment Station are yielding results which have an important bearing not only upon the breeding and selection of fowls for egg production but also upon the broader problems of breeding animals for production in general. The poultry-feeding experiments at the Bureau's experiment station have been seriously interfered with by the reappearance of coccidiosis, or white diarrhea, in the flock. Feeding experiments with cottonseed meal indicate that 30 per cent of this material is as high a pro-

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portion of the ration as the fowls will eat readily, but no harmful effects from this feed have been observed. Cowpeas, soy beans, and dried beet pulp have also been used experimentally as poultry feed with satisfactory results.

Work for improvement in the methods of handling eggs has been undertaken, and while it has not progressed very far it is certain that better methods will bring about a great reduction in the heavy losses experienced in the egg trade.

BREEDING HORSES FOR ARMY USE.

For some years the United States Army has found great difficulty in obtaining a sufficient supply of horses of a suitable character, and this condition led the Secretary of War during the past fiscal year to invite my cooperation in working out some plan for meeting the difficulty. A representative of this Department was accordingly designated to confer with the representative of the War Department, and these gentlemen have submitted reports pointing out the necessity for Government encouragement of breeding army horses and outlining a definite plan with an estimate of the cost. It appears that on the present peace footing the mounted service of the Army requires from 2,000 to 2,500 horses a year, and in order to supply this number of suitable animals it is estimated that at least 100 stallions would be required. These stallions should be purchased and owned by the Government, and arrangements should be made for the use of privately owned mares of suitable type and breed, the War Department to have an option on the purchase of the foals. It is estimated that the cost of putting such a plan into execution would be $250,000 for the first year for the part of the work to be administered by the Department of Agriculture, and that the annual expense of maintaining this work thereafter would be about $100,000. It seems essential that the Government should undertake some plan of breeding suitable horses if the efficiency of the mounted service of the cavalry and artillery branches of the Army is to be maintained, and such a plan would also have experimental possibilities of high value to the horse-breeding industry.

WORK RELATING TO THE DAIRY INDUSTRY.

DAIRY FARMING INVESTIGATIONS.

The average production of dairy cows in the United States is entirely too low, and there is no doubt that it can be raised considerably by proper methods. It is important that the dairyman should know which of his cows are good producers and which are kept at a loss, so that the latter may be eliminated and the herd built up with profitable cows. The best known method of doing this is by keeping records showing for each animal as closely as possible the cost of maintenance

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and the yield of milk and butterfat. Purebred bulls should be used for the improvement of the dairy herd. Work in this direction is being actively carried on by the Dairy Division of the Bureau of Animal Industry in cooperation with state authorities, dairy associations, and other agencies in the South and West. Besides assisting the farmers in keeping records and introducing purebred sires, the Department furnishes plans for dairy barns, silos, dairy houses, etc., gives advice as to the erection of these buildings, and assists in the organization of dairy and live-stock associations.

Cow-testing associations are an effective means for improving dairy herds and increasing their yield, and the Department has two men engaged in giving assistance in organizing and conducting these associations. This work is done always in cooperation with state officials or some state or local institution. Twenty-eight new associations were formed during the past fiscal year, making a total of 55 now in operation in the United States. As an example of the value of the work done by these associations, the records of one of them show that in four years the average annual profit on each cow has been practically doubled, having been raised from $21.43 to $42.82, while the average return for each dollar expended in feed has been increased from $1.64 to $1.98.

IMPROVEMENT OF CREAMERY BUTTER.

The Bureau of Animal Industry has continued the inspection of butter as it is received at the New York, Chicago, and San Francisco markets, this inspection being made at the request of the dealer or producer and the defects being pointed out and suggestions made for remedying them. The competition among creameries for the purchase of cream, however, has resulted in cream being accepted which is sometimes in very bad condition, and as a result much creamery butter of an inferior quality is placed on the market. The Department is endeavoring to encourage improvement in the quality of creamery butter by inducing the creameries to discriminate against bad cream and by encouraging farmers to send their cream in a fresh and wholesome state. It is found that good cream naturally produces a higher grade of butter, which commands a better price on the market, so that good cream should yield the farmers a better price.

IMPROVEMENT OF MILK SUPPLIES.

The Department has also continued to work both independently and in cooperation with city authorities for the improvement of public milk supplies. The score-card system of dairy inspection is recommended and has given good results in improving the sanitary condition of dairies. It is being used in 117 cities and towns, including some of the largest cities in the country. As a result of these coop-

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erative efforts great improvement has been brought about in the milk supplies of a number of cities.

After the milk dealer has delivered wholesome milk to the consumer it is important that the latter should handle and keep it in a sanitary manner until it is used. To meet the needs for information on this subject the Department has issued a Farmers' Bulletin on "The Care of Milk and Its Use in the Home," which is being widely distributed.

DAIRY PRODUCTS INVESTIGATIONS.

Investigations regarding the manufacture of butter and cheese and the bacteriology and composition of milk have been continued. Additional work during the year has confirmed the previous conclusions as to the superior keeping qualities of butter made from pasteurized sweet cream. Studies have been made to determine the best temperature for pasteurizing cream for butter making, and 160° F. seems to give the best results.

A bacteriological study has been made of commercially pasteurized and raw market milk as publicly sold in three large cities, from which it is concluded that there is no development of bacteria in such pasteurized milk that could be said to make it more unsafe than raw milk kept under similar conditions.

Investigations into various problems involved in the manufacture of cheese of the Swiss, Cheddar, Camembert, and Roquefort types have been continued, some of this work being done in cooperation with the Wisconsin and Storrs, Conn., agricultural experiment stations. The method of making cheese of the Cheddar type from pasteurized milk has been so improved that it is possible to bring factory milk into practically uniform condition every day, so that a definite routine method of manufacture may be followed throughout the year. The cheese produced by this method has been of high and uniform quality with almost perfect texture, and has commanded the highest market prices.

ERADICATION OF ANIMAL DISEASES.

For several years the Bureau of Animal Industry has been engaged in systematic work for the eradication of certain contagious diseases of live stock, and during the past fiscal year unusually good progress has been made.

TICK ERADICATION.

The work for the extermination of the ticks which spread the contagion of southern or splenetic fever of cattle means much for the future of cattle raising, dairying, and general agriculture in the South. Aside from communicating the disease mentioned, these ticks have such an adverse effect upon the condition of cattle which they infest that it is almost impossible to breed and raise a good

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quality of cattle in the tick-infested region. Since the summer of 1906 the Department has been engaged in an effort, in cooperation with state and local authorities, to exterminate these ticks. During the past fiscal year, as a result of the eradication of ticks, there were released from quarantine 57,518 square miles of territory, which is the largest area released in any one year since the beginning of the work. The total area so far released amounts to 129,611 square miles, an area greater than the combined territory of the States of North Carolina, South Carolina, and Tennessee. The States in which areas have been released from quarantine are Virginia, North Carolina, South Carolina, Georgia, Kentucky, Tennessee, Mississippi, Arkansas, Oklahoma, Texas, and California. The work is also being carried on in Missouri, Alabama, and Louisiana.

In the sections that have been freed from ticks and released from quarantine it is now practicable to introduce and raise a better class of cattle, and the cattle in these regions are more thrifty and command substantially better prices, not only because of their better condition but because they can be marketed without quarantine restrictions.

SCABIES OF SHEEP AND CATTLE IN THE WEST.

For more than ten years the Department has been working in cooperation with state authorities to eradicate the disease known as sheep scab, which has heretofore been prevalent in the West. During the fiscal year 390,000 square miles of territory under quarantine on account of this disease were released, comprising the entire State of Washington and parts of Oregon, Nevada, Utah, Arizona, and Colorado. It was found necessary to place a quarantine on the State of Kentucky on account of the continued spread of this disease in that State. At that time there was no efficient state law under which the Department could cooperate in combating the disease, but the last session of the Kentucky legislature passed an act creating a state live-stock sanitary board with power to deal with infectious and contagious diseases of animals, and arrangements have now been made to carry on cooperative work in that State for the eradication of sheep scab.

As a result of similar work for the eradication of scabies of cattle there were released from quarantine during the fiscal year 53,021 square miles, consisting of areas in Montana, Wyoming, Colorado, Nebraska, Kansas, and Texas.

In connection with the work for the eradication of scabies in sheep and cattle, employees of the Bureau of Animal Industry made 52,749,920 inspections of sheep and 18,190,456 inspections of cattle, and supervised 12,153,356 dippings of sheep and 1,336,829 dippings of cattle.

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NECROBACILLOSIS IN SHEEP.

About two years ago a form of necrobacillosis, known as lip-and-leg ulceration of sheep, appeared in Wyoming in such a malignant form and spread to such an extent as to necessitate a Federal quarantine in August, 1909. The Bureau of Animal Industry has made scientific and practical studies of this disease and of methods of treatment, and has conferred and cooperated with sheepmen and state authorities in repressing it, with the result that its prevalence has been greatly reduced. The drought of the past season has afforded favorable conditions for combating the disease and has also no doubt contributed somewhat to the good results. A circular describing the disease and recommending methods of treatment was prepared and issued by the Bureau and has been widely circulated in the affected region. The Bureau has also kept a force of veterinarians in the field to assist in treating the disease as well as to enforce the quarantine. About one-fourth of the quarantined area has been released, and the number of cases of the disease in the territory remaining in quarantine has been greatly reduced, besides which the extension of the disease to other sections has been prevented.

BOVINE TUBERCULOSIS IN THE DISTRICT OF COLUMBIA.

It has been well known in recent years that tuberculosis exists to a considerable extent among the cattle of the United States, especially among dairy cattle, and that where no adequate steps have been taken for the suppression of this disease it has increased in prevalence and extended to hogs. During the past two years the Department has made special investigations to determine the prevalence and extent of tuberculosis among cattle of various parts of the country, and has studied methods of eradication. The Bureau of Animal Industry has given active aid to state and municipal authorities and to individuals in suppressing this disease.

As the District of Columbia is under the jurisdiction of the Federal Government, it was thought well to undertake the eradication of tuberculosis from the cattle of the District, both in the interest of a wholesome milk supply and as a demonstration of what could be accomplished by certain methods of dealing with the disease. A cooperative arrangement was entered into with the Commissioners of the District, whereby all the cattle in the District were tested with tuberculin and those that reacted were slaughtered under inspection. Condemned cattle were appraised before slaughter, and reimbursement was made to the owners from Department funds on a scale depending upon the result of post-mortem examination. Over 18 per cent of the cattle in the District gave reactions to the tuberculin test, and in 98½ per cent of these the lesions of tubercu-

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losis were demonstrated on post-mortem examination. All new cattle brought into the District have to be submitted to the tuberculin test, and it is also proposed to retest the herds at intervals so as to detect any cases that may have developed since the first test. As a result of this work the cattle of the District are already practically free from tuberculosis, and it is believed that by continuing the retests for a reasonable time the disease will be completely eradicated from the cattle of the District.

Cooperation has also been extended to the States of Maryland and Virginia in applying the tuberculin test to cattle in those States.

HOG CHOLERA.

The efficiency of the method of serum treatment devised by the Bureau of Animal Industry for the prevention of hog cholera has been still further confirmed by practical experiments during the past year. A striking demonstration was made at the Kansas City stock yards. Out of a lot of 35 pigs, 22 were injected with Bureau serum, 4 were inoculated with virulent hog cholera blood, so as to give them the disease, and 9 were not treated in any manner. All were placed in a pen together. The 4 inoculated pigs contracted hog cholera and died, also the 9 untreated pigs, while the 22 pigs treated with serum remained well. A similar experiment at South Omaha gave equally good results.

The Department has continued its efforts to encourage and assist state officials in preparing the serum for sale or distribution to hog raisers, and has also carried out scientific experiments with a view to improving the methods and reducing the expense of producing the serum. It has been shown beyond doubt that this serum is an efficient agent for protecting hogs against hog cholera and that by its use in a systematic way this disease can probably be eradicated.

SCIENTIFIC INVESTIGATIONS OF ANIMAL DISEASES.

The Bureau of Animal Industry has continued its scientific investigations into the nature and cause of various diseases of animals. Considerable attention has been given, as heretofore, to tuberculosis, and especially to methods of immunizing cattle against this disease. The only methods of immunization which have given promising results have required the use of living tubercle bacilli, so that these methods can not be considered free from danger, and the Department is not yet prepared to recommend their use.

Other diseases under investigation during the past year are lip-and-leg ulceration of sheep, swamp fever of horses, chronic bacterial dysentery of cattle, bighead of sheep, glanders of horses, rabies, and anthrax. Experiments made at the suggestion of a European correspondent with a new method for the diagnosis of glanders have

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shown the great value of this method, and indicate that it will be found much more satisfactory and reliable than the mallein test and other methods heretofore in use, especially in the detection of incipient cases.

As injurious results sometimes follow the feeding of cotton-seed meal, experiments have been under way with a view to determining the cause of this trouble and learning if possible how this valuable feed may be utilized without danger. Laboratory experiments have indicated that cotton-seed meal made from certain varieties of cotton, or meal in the manufacture of which a high temperature is applied, may show poisonous properties, while the meal from other varieties and that made in other ways is harmless. Work is in progress on the identification of the specific poisonous principle and the further elucidation of the various problems encountered.

The number of rabid animals brought to the Department for diagnosis indicates the continued prevalence of rabies in and around the District of Columbia and other regions. During the fiscal year 116 cases were examined, consisting of 100 dogs, the remainder being cattle, calves, mules, and sheep. These animals had bitten at least 59 persons and 46 animals, so far as known. Seventy-five of the suspected cases were found to be positive. Experience has shown that the muzzling of all dogs for a sufficient period is the best means of reducing and eradicating this dangerous disease.

BLACKLEG VACCINE, TUBERCULIN, AND MALLEIN.

The Bureau of Animal Industry has continued the preparation and distribution of vaccine for the prevention of blackleg in young cattle, and the returns show a still further reduction in the losses from this disease. During the fiscal year about 1,000,000 doses of this vaccine were distributed among stock raisers.

The activity of various state and municipal veterinary and health officers has resulted in an increased demand for tuberculin, which is supplied by the Department to such officials free of charge for use in the diagnosis of tuberculosis in cattle. About 350,000 doses were prepared and distributed during the fiscal year. Nearly 75,000 doses of mallein for the diagnosis of glanders in horses were also prepared and distributed.

INSPECTION OF EXPORT ANIMALS.

The Bureau of Animal Industry made during the fiscal year 328,078 inspections of animals for export, including 62,372 inspections of Canadian animals in transit. There were inspected on arrival at British ports by Bureau inspectors stationed there 193,259 animals from the United States and Canada. During the year 443 inspections

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of vessels carrying live stock were made in order to see that equipment, ventilation, feed, water, attendants, etc., conformed to the regulations.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

In order to prevent the introduction of contagious diseases of live stock the Bureau makes a rigid inspection of all imported animals at ports of entry, and in certain cases a quarantine is imposed. During the fiscal year 346,650 imported animals were inspected, 9,783 of which were also quarantined.

LEGISLATION NEEDED.

The work of the Department in dealing with the live-stock industry, and especially with communicable diseases of animals, has shown the need of further legislation by Congress in order to remedy defects in existing laws and to confer authority for additional work in the public interest. These matters are discussed in more detail in the report of the Chief of the Bureau of Animal Industry, but may be briefly enumerated as follows:

Authority for the Secretary of Agriculture to control the importation of vaccines, serums, antitoxins, tuberculins, and other preparations sold for the detection, prevention, or treatment of diseases of animals, and to supervise the preparation of such products manufactured in this country for interstate commerce; such authority to be similar to that already vested in the United States Public Health and Marine-Hospital Service with regard to such products used in human medicine.

Authority for the Secretary of Agriculture to waive the provisions of the so-called twenty-eight-hour law in cases of emergency when cattle are being shipped under quarantine restrictions and a strict compliance with the law might cause the spread of disease.

Authority for the Secretary of Agriculture to require the disinfection of any live-stock cars used in interstate commerce whenever such disinfection seems necessary to prevent the spread of disease.

Authority to regulate the shipment of different classes of live stock in the same cars in the interest of humane treatment and so as to prevent young and small animals, frequently of different species, from being trampled to death by larger ones.

Legislation prohibiting the shipment of dead animals in the same cars with live animals, a practice that prevails to some extent and is a source of danger of the spread of contagious disease.

Legislation providing for the inspection and supervision of dairy products in interstate commerce, with a view especially to preventing the widespread practice of shipping to creameries cream that is in such a condition as to be unfit to enter into the composition of a food product.

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An amendment to the present law regarding renovated or process butter, so as to apply to this product the provisions of the meat-inspection law so far as they may be applicable.

NEW EXPERIMENTAL FARM.

Under an item in the appropriation act for the Department of Agriculture for the current fiscal year an experimental farm at Beltsville, Md., has been purchased for the use of the Bureau of Animal Industry. This farm will provide facilities that have long been needed for experiments and investigations in breeding and feeding animals and in dairying, so that work of this kind can be kept separate from that relating to infectious diseases as carried on at the Bureau's experiment station at Bethesda, Md.

BUREAU OF PLANT INDUSTRY.

The Bureau of Plant Industry has continued its studies of plants in all their relations to agriculture.

PROBLEMS IN PLANT PATHOLOGY.

The crown-gall of cultivated plants has been shown to be cross-inoculable to an astonishing degree. Galls have been produced on various species belonging to widely different families by pure-culture inoculations with *Bacterium tumefaciens* isolated from the Paris daisy. This organism has been inoculated many times successfully into the peach, rose, hop, sugar beet, white poplar, and other susceptible plants. That from the crown-gall of peach has been many times inoculated into the Paris daisy, sugar beet, hop, and other plants. Successful cross-inoculations have also been obtained with the organisms isolated from the crown-galls of many other plants, among them apples affected with hairy-root, the cause of which has so long been a matter of conjecture and dispute.

A destructive tumor disease of limes and other citrus fruits has been shown to be of fungous origin and to attack not only limes, on which it was first observed, but oranges also, while artificial infections have been produced on pomelo, lemon, and *Citrus trifoliata*. Mycelium has been traced in the stem from 1 to 2 feet beyond any external sign of infection.

An extensive study has been made of the bud-rot of the coconut palm, which has caused enormous losses. The cause of the disease has been determined and extensive experiments carried on with a view to its prevention and eradication.

Considerable work has been done during the past year upon a new spot disease of cauliflower. The cause has been determined, a biological study of the parasite made, and many experiments carried on to determine the conditions under which infection takes place.

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Studies are also being made of the bacterial and fungous content of spoiled maize; the inter-relation of crown-gall organisms; the new and destructive Grand Rapids tomato disease; banana diseases, especially a very destructive blight of the whole plant, and of all sorts of bacterial diseases of plants.

FRUIT-DISEASE INVESTIGATIONS.—The new methods of spraying with sulphur compounds worked out by the pathologists of the Department have been widely adopted by apple growers. The investigations have shown that fine fruit can be produced and protection secured against fungous diseases without the injurious effects resulting from the use of copper compounds.

Bordeaux mixture is still probably the most effective all-round fungicide, but in the spraying of the apple it has to take second place, to be used only for special purposes, such as late treatment for bitter-rot. Special attention has been given to experimental work in perfecting the method of using the new sulphur sprays for the fruit-spot and leaf diseases, and in cooperation with the Bureau of Entomology studies have been made of the combined sprays of the sulphur and arsenic compounds, with which both diseases and insects were treated at the same time. In most cases fruit growers who have used the new sprays have secured fine crops of the best apples they have ever grown. The new types of spray injuries which resulted are unimportant and are probably avoidable.

The fruit-spot and leaf disease known as cedar rust or orange rust of the apple has been increasing in prevalence in the Blue Ridge and Allegheny Mountain district from Pennsylvania to Tennessee during the last few years. This past season the worst outbreak of this malady ever known has occurred. It has attacked mainly the York Imperial, but the Yellow Newtown and some other varieties have been affected. The fungus has its alternate generation on the red cedar. Previous investigations by pathologists have shown that the immediate proximity of cedars greatly favors the disease. Recommendations made in previous years to cut down cedars from the vicinity of commercial apple orchards have not been taken very seriously. During the present season, however, many cedars in dangerous proximity to orchards have been removed. The disease has not heretofore proved amenable to spraying, but it was shown during the last season that spraying will very largely prevent it if applications are made just before the period of general infection.

For two years attention has been called to the discovery of self-boiled lime-sulphur as a fungicide which can be used in the summer spraying of the peach for brown-rot and scab. In 1909 this spray was successfully used in combination with arsenate of lead. The preliminary experiments of last season were redemonstrated on a large scale in Georgia, Virginia, and West Virginia, resulting in a com-

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plete victory over the combination of fungous diseases and insect enemies. The promptness with which peach growers have accepted the discoveries is encouraging. The growing of fine peaches has received a great impetus through the removal of some of the factors which render the growing of this fruit uncertain.

On the Pacific coast the work of controlling pear-blight by eradication methods has been successfully carried out. In the Rogue River Valley of Oregon and in many districts of California the disease was decidedly less prevalent during the past season than at any time since the blight entered.

It has been demonstrated on the Pacific coast that the powdery mildew of the apple can be satisfactorily controlled by spraying.

Experiments in spraying for pecan scab were continued in South Carolina, and similar experiments were started in Georgia. Though the disease can be controlled by spraying, the desirability of avoiding it by the use of resistant varieties was made clear. Many of the commercial pecans are sufficiently resistant to serve the purpose admirably and may be top-grafted on affected varieties.

STUDIES IN FOREST PATHOLOGY.—The chestnut-bark disease has now spread to northern Massachusetts and New York, western Pennsylvania, and eastern West Virginia. There are, however, certain indications that it may not become serious south of the Potomac. The work of this Department has shown that with young ornamental trees and orchard trees the disease may be controlled by a cutting-out and pruning system, though this method is impracticable with large ornamental trees and forest trees. In localities where the disease is just appearing its progress can be materially checked, and perhaps prevented, by promptly cutting down the infected trees and burning up at least the bark and brush. After 25 per cent of the trees are infected it is too late to do anything. It is unfortunate that in matters of this kind greater cooperation by private owners is not possible. Had this disease started in a National Forest district having a cooperating pathologist it probably would have been eradicated as a matter of routine before infection became general.

White-pine seedlings diseased with blister rust appear to have been imported into some 230 localities in North America. All diseased seedlings thus far located have been destroyed, but it is by no means certain that all importations have been found. This disease affects mature trees, as well as nursery stock, and occurs not only on the white pine, but on the sugar pine, the western white pine, and probably all other five-needled pines. The importation of white-pine seedlings should be flatly prohibited, as the damage which this disease can do, and probably will do, if once established in America, is out of all proportion to the value of all white-pine

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seedlings ever imported or likely to be. Prohibition is the only efficient means of prevention, as the disease can not be detected in the shipment by any system of inspection.

One of the most discouraging features of reforestation is the prevalence in the forest nursery of damping-off and other seedling diseases which may sometimes destroy the entire annual output of a nursery, especially of coniferous seedlings. One of the commonest of these diseases, popularly called "blight," has been controlled at the Forest Service nursery at Halsey, Nebr., by slight and perfectly practicable changes in the management of water supply and shade. Damping-off of eucalyptus seedlings, a source in the past of great loss, proves to be preventable by selecting the proper soil for planting.

Data collected in the forest-disease survey indicate that in America timber decay and tree disease are second only to forest fires as causes of loss. In theory it is easy to remove diseased trees in the forest when cuttings are made, leaving only healthy individuals for seed trees, and so continually improve the health of the forest; but in practice so many questions of economy and differing local conditions are involved that many difficulties must be overcome. A great deal of attention will be given to working out this problem.

COTTON AND TRUCK-CROP DISEASES.—The wilt-resistant varieties of cotton and cowpeas which the Department has been breeding and disseminating for several years have been brought to a higher standard than ever before, but wilt and root-knot have been spreading faster than the improved varieties have come into use, so that many thousands of acres continue to be destroyed each year. The problem now is to reach the farmers with the new seed and methods. For this purpose a special campaign of education is being inaugurated, to develop breeders of the new cotton and cowpeas and to demonstrate the effectiveness of the improved varieties.

A rust-resistant asparagus has finally been secured, and the stock is being propagated with all possible dispatch.

New prominence has come to the potato wilt, a disease known for some years, by the discovery that it is very widespread and injurious in an inconspicuous form, causing premature ripening, as well as dry-rot in storage. It must be more widely understood, and preventive measures, such as longer rotations, must be adopted.

Black-leg, another new potato disease, is increasing through the use of infected seed, especially in eastern trucking districts. Internal brown-spot is common. The present varieties of potatoes are somewhat limited in their climatic adaptations, and the diseases that affect them emphasize the importance of a broadly planned line of breeding to develop new potatoes possessing disease resistance and stronger local adaptation through bringing from South America or elsewhere new strains for hybridization. Potatoes for the warmer States are especially needed.

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Potato wart, a new disease that is likely to prove very destructive if introduced into this country, has been causing alarm in Europe. Canada, Ireland, and other countries are quarantining against it, but the United States has no protection. It has already appeared in Newfoundland and has been brought once to Massachusetts. Several other diseases now in foreign countries may be introduced at any time. The experience with the chestnut blight illustrates the devastation that may ensue. This may even yet be repeated on a larger scale than with the white-pine blister rust unless Congress authorizes the Secretary of Agriculture to prohibit the entry of diseased plants and seeds.

WORK ON SUGAR-BEET IMPROVEMENT.

A campaign is being carried on to increase the average yield per acre of sugar beets. The tonnage produced in the United States is still lower than it should be. Some sections do not appreciate the need for thorough culture; others have attempted to grow beets continuously, and need to adopt rational systems of crop rotation. All need to maintain the fertility of the soil and to make beet growing a part of the system of permanent agriculture. Diseases are the underlying causes of low tonnage in some districts, and there the Department is concentrating its efforts to determine the best means of relief.

The improvement of American beet seed is being given much attention, and there are indications that the quantity grown in this country will increase greatly in the near future.

SOIL-BACTERIOLOGY AND WATER-PURIFICATION INVESTIGATIONS.

The results reported by cooperators using cultures of nodule-forming bacteria for inoculating legumes have indicated certain limitations to successful inoculation. Especially with alfalfa in the Coastal Plain region it has been found that inoculation is generally successful upon soils which produce a blue or neutral reaction to litmus paper, while upon those soils giving a red reaction to neutral litmus paper successful inoculation is seldom obtained. Extensive studies upon the nitrifying power of soils have been carried on in different parts of the United States, and a close relationship has been established between the nitrifying power of a soil and its crop-producing power. In none of the regions under investigation has any injurious effect from overnitrification been observed.

PROGRESS IN ACCLIMATIZATION AND ADAPTATION OF CROP PLANTS.

ACCLIMATIZATION OF NEW VARIETIES OF COTTON.—There are many desirable varieties of cotton, corn, and other economic species in the tropical countries where these plants had their origin and were first

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domesticated. The use of these superior varieties in the United States has been considered impracticable, owing to their general failure to produce a crop within the limits of the summer season. It has now been learned that the behavior of many of these imported varieties when first planted in the United States is abnormal and that they can be led back to normal fertility and earliness by a few seasons of acclimatization and selective breeding.

Several new types of Upland cotton have been introduced from Mexico and Central America and acclimatized in Texas. Although they yielded very little cotton at first, they have now become as productive and as uniform as any of the United States Upland varieties that are being tested in the same places. Some of the new types produce larger bolls and longer lint than any of the varieties now generally cultivated in Texas, and these advantages occur in combination with other desirable qualities, such as extreme earliness, tolerance of drought, and resistance to the attacks of the boll weevil.

LOCAL ADJUSTMENT OF COTTON VARIETIES.—The same biological factors of abnormal behavior that make it necessary to acclimatize imported varieties have also been found to affect the United States Upland varieties. A carefully bred variety that is uniformly early and productive in its home district may show much individual diversity when carried to a new place and may require a new course of selection to give it complete adjustment to the new locality. A large proportion of the plants that depart from the standards of the variety become distinctly inferior, like the reversions that occur more frequently in hybrid stocks and in primitive unimproved types of cotton. Failure to remove inferior "rogue" plants is one of the causes, if not the principal cause, of the rapid "running out" of varieties of cotton when selection is relaxed. Continued selection is necessary as a regular farm operation to maintain the uniformity and productive efficiency of high-grade varieties.

EXTENSION OF COTTON CULTURE IN THE UNITED STATES.—There is a general impression that the cotton-growing lands of the United States are all occupied and that the presence of the boll weevil will prevent any future increase of this crop, but this is a mistake. There are large possibilities for cotton production in the drier parts of the Western and Southwestern States, where the boll weevil can do little damage.

Experiments in Texas, Kansas, Arizona, and California indicate that cotton of excellent quality can be produced in many regions where none has been grown in the past. The status of the cotton as a dry-land plant is still very inadequately appreciated. It yields a marketable product with less water than any other crop now grown in the Southwest. A small amount of irrigation can be used more effectively with cotton than with any other crop, and even without

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irrigation cotton can often be grown on lands not now supposed to have agricultural possibilities.

INCREASED YIELDS FROM CORN HYBRIDS.—Numerous experiments have shown that crosses or hybrids between two kinds of corn are usually more productive than either of the parent varieties. Even in crosses of improved strains the yields are notably increased, sometimes more than 50 per cent, and the crossed plants are more resistant to disease and to unfavorable conditions of growth. Simple methods have been devised to enable corn growers to take advantage of this factor of increased production.

DRUG-PLANT INVESTIGATIONS.

During the past year the camphor work has made considerable progress. Seeds selected from trees showing a high camphor content have been propagated under various conditions, with the result that enough young trees are now ready to plant a large part of the test areas. The effort to secure improved apparatus for working up this crop has been continued with much success. Especial attention has been given to the development of the best form of condensing apparatus. The area of camphor planted as a result of private enterprise continues to increase at an encouraging rate.

In South Carolina the paprika-pepper crop has increased in size. The Department is supervising the growing of about 50 acres of peppers on a number of types of soil in different localities. Thus far the present crop promises to exceed former crops considerably. The reception of these peppers by spice millers has been favorable, and the demand for a large home-grown supply seems established. Work has been chiefly centered on paprika peppers of the Hungarian type, but since the market for the Cayenne type is much larger, future efforts are to be directed toward the production of pungent peppers. A growing demand is felt for a mild sweet pepper of high color, similar to the so-called "Spanish paprika," now imported in large quantities. Work on this important sort has demonstrated the great liability of this group of plants to disease, and ways of meeting this difficulty are being worked out. As soon as success is secured a material widening of the market for American-grown peppers will follow.

The hop work of the past year has been directed toward the improvement of varieties and toward better methods of handling the plants in the field. A statistical study of a small area has shown that in all probability certain methods of practice exert more effect than has been suspected. For example, it appears that a better yield is obtained when four to six vines are trained in a hill than when fewer are permitted to grow. The criteria to be used in judging hops are an important object of study also. At present there seems to be

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much disagreement among hop experts as to what constitutes the fundamental basis of quality. A study of certain constituents, especially of volatile oils, resins, and acids, is designed to throw light on this important question.

Work on tanning crops has been continued on a small experimental basis, test plats of promising plants being grown in different testing gardens of the Department. The commercial and agricultural requirements that must be met in order to bring success are many and rather exacting.

The tea work has been continued in South Carolina. Last season's outcome was very satisfactory from the standpoint of production and quality, and the increasing demand for American tea quickly absorbed the crop. More tea was sold in the Southern States than heretofore. Work on the pruning machine after many trials seems to have resulted in a practical means of eliminating a large item of expensive hand labor. Pruning, heretofore costing about $2.25 per acre, can now be done equally well at 50 cents an acre.

Perfumery-plant and volatile-oil investigations have shown that many of the foreign plants used for purposes of volatile-oil production can be grown and distilled satisfactorily in this country. A study of the native oil-bearing plants has developed the fact that among them are several species yielding oils containing constituents which make the foreign oils now imported commercially insignificant. For example, the native horse mints and their near relatives, growing luxuriantly on waste lands, yield oils rich in thymol, a valuable and much-used antiseptic now derived from foreign sources. Certain of the sagebushes of the arid plains of the West yield oils rich in substances now in demand. Native plants are well worthy of further study in this direction.

It sometimes happens that crude drugs come on the market in a more or less mixed condition, a situation at times not detected by the manufacturer or pharmacist using them; consequently, confusion as to the facts concerning crude drugs of native origin at times creeps in. Some time since the drug known as pinkroot was investigated by the Department, and the true status of the situation made clear. During the past year the same thing has been done with the wild-yam root, the true and the false types having been distinguished and the botanical sources of each ascertained.

POISONOUS-PLANT INVESTIGATIONS.

The field work on poisonous plants during the past year has consisted of two types: (1) Feeding experimentation, carried on at a temporary station located at Mount Carbon, Colo., and (2) reconnaissance work, carried on wherever complaints of considerable losses have seemed to demand attention. At Mount Carbon the harmful

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effects of larkspur poisoning due to species of *Delphinium* have been under study. The chief features of larkspur poisoning have been ascertained, and some progress has been made on relief measures.

In connection with reconnaissance work much attention has been given, as heretofore, to trouble in the National Forests. Frequently, as a result of a study of the flora of a suspected area, the source of loss has been identified and simple measures which have reduced the loss have been suggested.

Laboratory studies have been directed toward a variety of subjects, among others the further understanding of the loco-weed problem. It has been shown that the cause of this important disease is not yet well understood, and further work seems to be required. This is now in progress.

The relation of corn to pellagra has continued to receive attention. The normal constituents of corn and such as are developed under the action of agencies bringing about its deterioration have been sought in the hope of getting some light on the cause of this malady.

Some effort has been spent on a study of the alkaloids of the common solanaceous berries, both wild and cultivated. The utilization of a number of sorts for table use, together with reports of their harmful action, has made it necessary to get more information on the properties of these products.

PROGRESS OF WORK IN AGRICULTURAL TECHNOLOGY.

OFFICIAL COTTON GRADES.—Among the various technological problems carried forward within the past year, the work of cotton grading has been prominent, and in accordance with the recent act of Congress nine official grades of white American cotton have been promulgated. Twenty-five sets of these types have been prepared for storage in vacuum for the purpose of comparison in future years. This method of securing the permanency of the types is believed to be a most fundamental and important improvement over methods previously in use. A limited number of sets of the grades were placed with agricultural colleges in the cotton belt and with exchanges, institutions, and individuals who had rendered service in connection with the project and whose facilities were at the disposal of the Department for quickly bringing the official types to the attention of the cotton industry. Before this preliminary distribution was finished the general sale of the grades was begun, and the official types have for some time been supplied to all applicants at the cost of preparation, so that the sets now in practical use cover a much wider territory.

The official grades were established with the advice of a committee composed of men of the highest standing drawn from every department of the cotton industry. Numerous letters approving these

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grades have been received from prominent American cotton interests, while prominent members of foreign exchanges who have seen the official types have expressed themselves in terms of high commendation. In no case have the official types been subjected to hostile criticism.

Original methods of preparing and preserving these types have been developed, and the integrity of each box is attested by a full-sized photograph of its contents, which is secured in its cover and bears the certificate of the Secretary of Agriculture and the seal of the Department.

Investigation of the length and strength of cotton fiber, with a view to measuring these qualities more accurately, has been actively prosecuted, and great progress has been made, while the problems of cotton marketing have received further study in the field. A new method of measuring the length of cotton staple by projection, which it is believed will prove of very great value to the cotton industry, has been devised and perfected.

PAPER-PLANT INVESTIGATIONS.—Technological work on crop plants which may be used for making paper has been actively prosecuted during the year and has resolved itself into an investigation of three classes of material: (1) Wastes or by-products of farm crops, such as the stalks of corn and broom corn; the straws of rice, flax, etc.; hemp waste; and bagasse; (2) plants which give promise of being profitably grown expressly for paper-making purposes, such as hemp, esparto, and jute; and (3) wild plants which are locally abundant and possibly suitable, including certain grasses, rushes, sedges, and canes.

Strikingly favorable results have been obtained from broom-corn stalks, which have been tested in lots up to 3½ tons and found to yield as high as 42 per cent of available fiber, which, when combined with an equal quantity of poplar pulp, produced a good quality of book paper. It can be conservatively stated that this crop by-product is suitable for immediate use in paper making. The pulping of cornstalks has not been as satisfactory, but good qualities of paper of different finishes have been produced from numerous varieties of corn.

FIBER INVESTIGATIONS.

In the fiber investigations of this Department special attention has been given to hemp, flax, and sisal. The importations of those three fibers during the fiscal year ended June 30, 1910, amounted to 119,150 tons, valued at $16,016,416. Hemp grown in 1909 in Wisconsin, in cooperation with the Wisconsin Agricultural Experiment Station, has been retted and broken, and the fiber has been sold to manufacturers at very satisfactory prices. Cooperative experiments

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were continued in Wisconsin in 1910, and a series of similar experiments was begun in Iowa. The hemp made a very satisfactory growth considering the unusually dry season in those States. It has been harvested and spread for retting.

Flax from seed of carefully selected plants of fiber-producing types was grown in nursery plats in eastern Michigan. A study has been made in the field of the flax grown for fiber in Michigan and of that grown for seed in Minnesota and adjacent States. Selections of plants have been made with a view to the development of uniform varieties having the characters most desired for these special uses. Attention is also being devoted to an increased production of flaxseed to meet the growing demand for this seed in the manufacture of linseed oil.

Sisal, henequen, and zapupe plants cultivated in cooperation with the Porto Rico Agricultural Experiment Station and the Porto Rican government are making a very satisfactory growth.

A planting of sisal and allied fiber-producing agaves and furcræas has been made in a cooperative experiment on Sugar Loaf Key, Florida. The young plants have made a very promising growth. The conditions of soil and climate on the Florida keys are very similar to those in the Bahamas, where the production of sisal has become the leading industry in recent years.

GRAIN STANDARDIZATION.

That the relations between scientific agriculture and the commercial conditions which affect crops after they are produced are important has of late come to be more fully realized. To improve market conditions where possible is to render a valuable service to agriculture.

With this object in view the Department has undertaken a scientific study of the commercial conditions which affect the grain crops after they have been produced—specifically, a study of the methods employed in harvesting, storing, transporting, grading, and marketing these crops and the extent to which the various methods affect their relative commercial and intrinsic values.

Extensive experiments have been carried on with corn stored under actual commercial conditions in country and terminal grain elevators at various points. Rail shipments of corn from points within the surplus-corn States to export points upon the Atlantic and Gulf seaboards and shipments of a cargo of corn from each of these seaboards to European ports were accompanied in each case by an expert who had the corn under careful observation at regular intervals en route. Many rail shipments of corn, principally between the large grain markets, were examined and tested at the points of shipment, and also at their destinations. Corn stored in farm cribs at various points was also under observation at regular intervals.

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The most important fact demonstrated is that a large proportion of the corn which finds its way into commerce contains excessive quantities of moisture, that under most favorable conditions no appreciable reduction of this moisture takes place until March and April, and that this excessive moisture is the primary cause of corn spoiling in large quantities under commercial conditions.

The methods of handling and marketing wheat have likewise been studied during the year. More than 300 samples of the various varieties, classes, and grades of wheat were obtained. In cooperation with the North Dakota Agricultural Experiment Station, these samples were experimentally milled and baked with a view to correlating the physical characteristics of wheats with their flour and bread making qualities. The present indications are that these factors may be correlated and a better understanding of wheat values brought about.

The effect of excessive moisture, "weathering," and the sulphur bleaching of commercial oats and barley has likewise been studied during the year, and much information relative to these subjects was obtained.

The results of laboratory experiments with commercial flaxseed indicate that this seed will increase considerably in volume and decrease proportionately in test weight per bushel while being handled and stored commercially, probably on account of the abrasion or roughening of the seed coat during the various handlings necessary.

SEED-TESTING LABORATORIES.

During the past year additional seed-testing laboratories have been opened in cooperation with the North Carolina Department of Agriculture and the Purdue University Agricultural Experiment Station. The laboratories in Nebraska, Missouri, and Oregon have been continued. The work of each of these laboratories has increased approximately 50 per cent each year since they were started, showing the interest taken in them by the public. The Department is cooperating with state institutions in order that the work may be done locally when analyses can be furnished, with a great saving of time.

During the summer a number of representatives of seed firms have taken advantage of the opportunities offered by the laboratory to become familiar with the technique of seed testing in order to carry on similar work for themselves.

Samples of forage-plant seeds have been collected and examined for the presence of adulterants, and the names and addresses of the dealers who offered adulterated seeds for sale have been published, as formerly, with the result that fewer lots of adulterated seeds have been found the past year than in any preceding year.

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PROGRESS IN GRAIN INVESTIGATIONS.

WINTER-WHEAT EXTENSION.—For some time efforts have been made by the Department to extend the area of possible cultivation of hard winter wheat by the introduction of varieties hardier than those now grown. The Kharkov variety, which so far has been found to be the best, has given unusually good results this season. The total annual production of this wheat is now between 15 and 20 million bushels.

DURUM WHEAT.—In the last report the annual production of durum wheat was stated to be nearly 50 million bushels, but it is no longer possible to give even approximate statements of the production. Durum-wheat flour is commonly used in a number of eastern cities, particularly Baltimore, Washington, and Richmond, a single firm having disposed of five carloads in the last-named city in three months. For the first time a prominent milling company is advertising the flour on its own merits, a matter which has been urged by this Department for some time.

PACIFIC COAST INVESTIGATIONS.—Following the demonstration of the adaptation of Chul and Fretes wheats to California by this Department, seed of pure strains is being increased as rapidly as possible for distribution. Already the yields obtained show the superiority of these varieties.

INFLUENCE OF ENVIRONMENT ON THE COMPOSITION OF GRAIN.—Experiments conducted for a considerable length of time seem to show that different kinds of soil have very little influence on the quality or yield of grain, but that changes of climate have considerable effect.

CROPS IN ROTATION WITH CEREALS.—Rotation experiments have been conducted in a number of places to determine what crops are best for growing in alternation with cereals in order to obtain the best results with the latter. Where legumes were employed in these rotations the results have confirmed those of other experiments in showing the importance of such crops preceding wheat. In California the value of green rye turned under in preparation for wheat seeding was also shown. Both rye alone and a mixture of rye and vetch plowed under green gave a very much greater yield of wheat than that obtained on summer fallow, and a still greater increase over that obtained where wheat followed wheat.

TIME AND RATE OF SEEDING GRAINS.—From several years' investigation of the best time and rate for seeding grains the chief conclusion of general interest is that a smaller quantity of seed may be employed in the drier districts than in humid areas. The proper quantity of wheat, for example, to be sown to the acre in semiarid districts

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averages nearly 3 pecks, while in the humid portions of the eastern United States it is common to sow from 5 pecks to 2 bushels.

DRY-LAND GRAIN INVESTIGATIONS.—Dry-land grain experiments are now conducted at Amarillo and Dalhart, Tex.; Akron, Colo.; Bellefourche and Highmore, S. Dak.; Williston and Dickinson, N. Dak.; Philbrook, Mont.; Nephi, Utah; and Moro, Oreg. The farm at Moro, Oreg., was added during the year and is conducted in cooperation with the Oregon Agricultural Experiment Station.

GRAIN-SORGHUM INVESTIGATIONS.—Selected dwarf and early varieties of kafir and milo produced during the past season, in spite of the intense dryness, 25 to 50 per cent of their normal yield, while the ordinary larger and later varieties made an average of only 10 to 25 per cent of their normal yield.

Further experiments continue to show the great hardiness and earliness of the Chinese or kowliang sorghums. Considerable work has been done through chemical analyses and milling and baking experiments to determine the probable food value of several kinds of grain sorghum.

RICE INVESTIGATIONS.—Experiments were started this year in South Carolina to determine the best means of controlling rice blast ("rotten-neck") by preventive measures.

During the summer experiments were also begun in Florida to determine the possibility of growing rice on the land lying between the Everglades and the ocean. Portions of this area during the winter months are profitably used in trucking, but are too wet in summer and early autumn to grow on a commercial scale any other crop than rice.

Experiments in California were conducted on three types of soil covering a large area in the Sacramento Valley. Two years' results indicate the possibility of growing rice in that region on a commercial scale, the important thing now being to determine the varieties best adapted to the region.

Interesting results are being obtained in the rice investigations in Louisiana and Texas. In the former State special attention has been given to the eradication of red rice, with some results that are encouraging.

OAT INVESTIGATIONS.—Some very promising pedigree strains of spring oats have now been produced in sufficient quantities to be grown in field tests for the first time.

Considerable progress has been made in the selection of hardy winter strains, a number now being grown on the Arlington Experimental Farm which have developed a considerably greater degree of hardiness than ordinary winter oats. This year several of these strains weighed from 34 to 36 pounds to the measured bushel.

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The value of the varieties of oats introduced by this Department was further shown this year. The Swedish Select is now one of the leading varieties in the Northern States, the production in Wisconsin alone being estimated by authorities in that State at 45 or 50 million bushels. The Sixty-Day, another of the Department's introductions, is fast becoming the most popular oat in the corn belt.

BARLEY INVESTIGATIONS.—Of the barley varieties introduced by the Department, the Gatami, from Manchuria, promises, after several years' trial, to be of much importance. It ripens from one week to ten days earlier than other six-rowed varieties now grown in the Northwest and also yields better than many of these varieties.

A method of selecting seed barley has been devised by taking advantage of the varying specific gravity of different cereals and other seeds and of seeds of the same cereal in different conditions, and a circular on the subject has been published.

The attempt to produce a true awnless variety of winter barley was finally successful, it having resulted from a cross of Tennessee Winter barley, a six-rowed variety, and Black Arabian, a two-rowed black barley. This new barley is quite distinct from the old so-called beardless barley, being a true awnless variety, and it appears to be very prolific.

Another result from the same cross is the fixation of a new hooded barley which ripens one week earlier than other hooded varieties.

CEREAL-DISEASE WORK.—The great damage that continues to be done to cereal crops by rusts has been the incentive to give these diseases much further attention, and during the year a bulletin has been published giving considerable new information, particularly with regard to the manner of living over from year to year, the important relation of the weather to rust epidemics, and methods of securing varieties of grain resistant to rusts. Breeding grains for rust resistance has been continued.

Preliminary experiments have been made with cresol for the prevention of smuts, the results of which indicate that this substance may become an important fungicide for use with stinking smut of wheat and smut of oats. There is promise, also, that the modified hot-water treatment for loose smut may be further simplified, thus making it easier of application.

Preventive measures for sorghum smuts have been improved upon, and results of investigations have been published.

INVESTIGATIONS IN THE SOUTHERN STATES.—During the past year there has been a striking increase of interest in grain cultivation in the South, no doubt partly due to the increased attention being paid to diversification of crops and partly to the increased price of wheat and other cereals. It is hoped that special attention may be given during the coming year to such questions and that much more help may be given to farmers than has formerly been possible.

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CORN INVESTIGATIONS.

The corn work has been of greater value and of greater interest than in any other year. It has brought out the possibilities of the crop, which is already by far the most valuable one of the country, but which, when better understood and better cared for, will more than double its value.

The breeding of early maturing varieties of corn for the Northern States and the greater interest in corn growing in the Southern States are rapidly increasing the acreage planted to this crop. The acreage in 1909, greater than that of any previous year, was 5 per cent less than that of 1910. The tests of the last two years show that the rich delta lands of the Mississippi River are well adapted to corn growing, and conditions there are such that the crop can be harvested and shipped advantageously and in a drier condition than northern-grown corn.

The production last year of 100 bushels of corn per acre on large tracts and over 200 bushels on contest acres in States that average 25 bushels or less to the acre is sufficient argument in favor of more intensive corn culture.

The past year has marked a great improvement in regard to corn contests. Competitors generally have come to realize that he is the most successful who produces good corn most profitably without injury to his land. It is gratifying to note that awards for highest and most profitable yields are taking the place of awards for most uniform and most beautiful ears.

TOBACCO INVESTIGATIONS.

The tobacco investigations have included work with most of the principal cigar, manufacturing, and export types, covering ten of the leading tobacco-growing States. In addition to special problems in harvesting, curing, fermentation, and the control of diseases, there are three broad problems in tobacco culture which have received special attention, namely, the production of improved types by breeding and selection, the determination of the best use of fertilizers, and the development of systems of crop rotation best adapted to the production of tobacco from the standpoint of both quality and yield.

In the Broadleaf belt of the Connecticut Valley it has been shown that the use of phosphates more readily available than those ordinarily applied by growers gives a marked increase in the yield of tobacco. Further experiments in the steam sterilization of seed beds indicate that in addition to destroying weed seeds and fungous diseases this treatment reduces the injury from the mosaic or calico disease, one of the most widespread troubles affecting any crop plant. The value of the system devised by the Department of introducing artificial

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heat into the curing shed has been clearly demonstrated, particularly in connection with the new method of harvesting by picking the leaves from the stalk, which is rapidly coming into use in the Connecticut Valley.

In New York the Haynes type of tobacco as improved by careful selection is rapidly supplanting other varieties grown for filler purposes. In Ohio new types have been secured by five or six years' systematic breeding which are more productive than the ordinary Zimmer and Seedleaf varieties, and these are being grown commercially this season for the first time. Similar work has been carried on in Pennsylvania during the year, and a Farmers' Bulletin outlining practical methods of growing tobacco in the State, with suggestions for their improvement, has been issued.

In the export and manufacturing districts of Maryland and Virginia, experiments and demonstrations in the best use of fertilizers and systems of crop rotation especially adapted to tobacco culture have been continued. The development of improved types and strains by breeding and selection and row-to-row variety tests has received much attention. In Maryland a variety developed from a cross between Connecticut Broadleaf and a native Maryland tobacco is showing marked superiority in yield and size and is giving satisfaction in the hands of a number of farmers. In Virginia local stations have been maintained in the principal tobacco districts.

A problem of vital importance to the tobacco industry of the so-called "old belt" of North Carolina, more particularly in Granville County, is the control of the Granville wilt. This problem has been taken up from the standpoints of breeding resistant varieties and of developing systems of rotation, fertilization, and cultivation which will control the disease. In the "new belt" of eastern North Carolina and South Carolina much complaint is heard from the trade as to the poor burning qualities of the tobacco, and this matter is now being investigated, mainly from the standpoint of improving the formulas of the commercial fertilizers now used.

In connection with the fertilizer experiments in the various tobacco districts, tests are being made of the efficiency of some of the new commercial sources of nitrogen, more particularly calcium cyanamid and also of ammonium sulphate, for the various types of tobacco. These tests are of special importance because of the high cost of such standard nitrogenous tobacco fertilizers as cotton-seed meal.

DRY-LAND AGRICULTURE INVESTIGATIONS.

The results of the investigations in crop rotations and cultivation methods in the Great Plains region east of the Rocky Mountains and west of the ninety-eighth meridian have been of unusual value and interest during the past season. Drought, more or less severe, has

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been experienced from Montana and North Dakota to Texas. At Williston and at Edgeley, N. Dak., the conditions were so severe that all crops were practical failures, although the most approved methods of moisture conservation were used on some of the plats; but even here many valuable lessons were learned, and if the drought had been less prolonged very remarkable differences would have been observed in the yields due to different methods of cultivation and crop rotation. This brings out very strongly these two important facts: (1) No system has yet been devised that will insure crops during periods of as severe drought as sometimes occur in this region, and (2) properly planned and executed rotations and tillage methods will greatly reduce the loss by droughts of only moderate severity, such as frequently occur here. These same methods will also increase the yields and net profits during favorable years. In Texas, Kansas, Colorado, Nebraska, and Montana the drought was less severe. At the stations in those States the results obtained from the various methods employed were unusually uniform and consistent, not only when station is compared with station during the past season, but also when comparisons are made between different grains. These results are also in a general way remarkably consistent with those of previous years.

The experimental farms established and managed by the Office of Dry-Land Agriculture are proving of great value for carrying on cooperative work with other offices of the Bureau of Plant Industry, with other Bureaus of the Department, and with the state experiment stations. This cooperative work should be still further extended, developed, and systematized, particularly along the lines of plant nutrition and soil bacteriology. The establishment of a permanent and profitable agriculture in the immense area known as the Great Plains is an undertaking of such magnitude and economic importance as to demand the very best cooperative efforts of both state and Federal agencies, and this cooperation is being effected in a most efficient manner by this Department.

The main points established by the investigations up to the present time are as follows: (1) Crop rotations calculated to conserve the organic matter as well as the moisture in the soil are the main dependence to guard against loss from deficient rainfall. (2) The effects of rotations are cumulative, and these investigations must be conducted systematically through a long term of years and at many stations in order to establish a safe basis for a permanent agriculture.

PHYSICAL INVESTIGATIONS.

Physical measurements are being made at all of the dry-land experimental farms to determine the methods of cultivation which are most effective in conserving soil moisture and the amount of

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water required by the different crops. It has been found that the evaporation from a freely exposed tank of water is the best criterion of the water requirements of a crop, as this gives the combined effect of temperature, humidity, and wind. The evaporation has been shown to vary greatly in different dry-farming sections, being nearly twice as great in northern Texas as in North Dakota. A higher rainfall is consequently necessary in regions of high evaporation. This is a subject which every prospective settler in dry-farming regions should study carefully, and will be found fully discussed in a recent publication of the Department.

PROGRESS OF WORK AT FIELD STATIONS ON RECLAMATION PROJECTS.

The Department is now operating field stations on the following reclamation projects in the Western States: Yuma (Arizona-California), Truckee-Carson (Nevada), Umatilla (Oregon), Klamath (Oregon), Huntley (Montana), North Platte (Nebraska), Williston (North Dakota), and Bellefourche (South Dakota). Among the more important features of the work are the testing of newly introduced varieties of crop plants, plant breeding, investigations in plant nutrition, experiments in the utilization of native forage and fruit plants, and experiments in tillage methods and crop rotations.

At the Yuma Project particular attention has been given to experiments in growing Egyptian cotton. It has been demonstrated that this type of cotton, characterized by the superior length, strength, and fineness of fiber, gives large yields and produces lint pronounced by American spinners equal to corresponding grades of imported Egyptian cotton.

The plant-nutrition problems offered by certain peculiar soil types of the Truckee-Carson Project are being chiefly investigated. Cooperative work by bacteriologists and physiologists of the Department looking to the correction of these unfavorable conditions is in progress. Experiments with orchard and small fruits seem to indicate that owing to the likelihood of late spring frosts in the valley bottoms the higher lands offer the best prospects of success. Alfalfa, the cereals, and sugar beets appear to be the most promising crops for the lowlands.

The Umatilla Project appears to be adapted to orchard fruits, grapes, and small fruits, such as strawberries These crops are therefore receiving special attention on the experiment farm.

On the Klamath, Huntley, Williston, and North Platte projects experiments were begun last year with the crops that appear to be best adapted to the respective local conditions. It is as yet too early to report results. On the Bellefourche Project water for irrigation has not so far been available on the experiment farm, and the work has been confined to dry-land agriculture experiments on that portion of the farm lying above the ditch.

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On several of these projects most of the settlers are unfamiliar with irrigation, and instruction and demonstration of methods of applying water is proving to be an important part of the work.

ALKALI AND DROUGHT RESISTANT PLANT-BREEDING INVESTIGATIONS.

The Department is engaged in extensive tests of crop varieties in order to ascertain which ones are most resistant to drought, and is seeking to secure increased resistance by plant-breeding methods.

Some of the problems which are being studied are: (1) Ability to adjust growth to available moisture, as varieties of grain crops, for example, that make a limited stem and leaf growth withdraw less moisture from the soil early in the season and have a better chance to ripen seed than do ranker growing, freely stooling varieties; (2) character of the root systems, whether extensive and shallow, permitting the fullest possible utilization of light rains, or deeply penetrating, thus tapping supplies of moisture at greater depths in the soil; (3) conservation of water by reducing transpiration or, in other words, increased economy in the use of water; and (4) avoidance of drought by maturing early before extremely dry weather begins or tolerance of drought through ability to arrest growth during dry periods, resuming development whenever a rainfall brings sufficient moisture.

In the arid and semiarid regions thousands of acres of hitherto untilled land are being taken up by farmers. As a rule the newcomer is unable to estimate closely the capabilities of the land until it has been put into crops. During the past three years correlations between the different types of native plant covers and the conditions influencing crop production have been worked out in portions of the Great Plains area, and these have made it possible to judge from the character of the natural vegetation the adaptability of the land for different crops.

The plant-breeding work with Egyptian cotton in the Southwest has resulted in the development of two new and distinct varieties quite different in the characters of the plants and fiber from the Mit Afifi stock with which the work was begun. The new types are distinguished by the large size of the bolls and the fineness and great strength of the lint, which averages in both varieties about 1⅜ inches long. One of them has already been tested on a field scale at several localities in Arizona and southern California, and has proved very satisfactory in yield and in the uniformity of the product. Strains have also been secured by selection which possess the characteristics of the Mit Afifi variety, but are greatly superior to the average of that variety as grown from imported seed in productiveness, size of bolls, and quality of fiber. The different types of fiber produced by these varieties are well adapted to most of the uses to which the $12,000,000

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worth of cotton imported from Egypt in 1909 was put by American spinners. In view of the prevailing high prices of long-staple cotton and the insufficiency of the present supply, it is hoped that the growing of Egyptian types of cotton will soon be taken up on a commercial scale in the Southwest.

THE RESEEDING OF DENUDED MOUNTAIN GRAZING LANDS.

It is clear from the season's study that acidity of the soil is a factor of the greatest importance, hitherto unconsidered, in the seeding of these mountain grazing lands. Hereafter experimental sowings will be made with reference to conditions of acidity as well as those of temperature and moisture.

As there are certain wild plants which grow only on acid lands and others which grow only on neutral or alkaline lands, the presence or absence of these indicative plants is an excellent practical guide for field work. The most trustworthy indicators of acidity are various plants of the blueberry and heather families, especially the species of the genus Vaccinium known in New England as blueberries but in the region of most of the National Forests called huckleberries.

TRUCK-CROP INVESTIGATIONS.

The efforts which have been made to develop and maintain strains and varieties of the standard commercial vegetables peculiarly adapted for specific purposes have proved decidedly successful. The crops now well in hand are lettuce, cauliflower, cabbage, beets, and tomatoes. Others will be taken up as rapidly as possible.

The Arlington Farm, which is the Department's field laboratory in plant industry, has developed into the most intensive enterprise of this character in America. The investigations under way at the farm are larger and more varied than those upon any similar farm in the United States. During the year the crop-improvement work alone involved the testing of more than 2,000 samples of forage crops, 7,000 samples of cereals, 1,500 samples of vegetables, 25,000 samples of potatoes, and 250 drug plants. The fruit plantations consist of over 500 sorts of apples and more than 300 varieties of peaches, and the shrubbery and ornamental trees now include 240 distinct varieties and species.

FRUIT INVESTIGATIONS.

From the citrange-orange crosses it is hoped to obtain fruits nearly if not quite equal in quality to the varieties of oranges now grown and at the same time possessing greater hardiness, enabling them to resist the occasional severe freezes which cause so much damage in the orange districts.

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DATE CULTURE.—The successful ripening at the Department gardens in Arizona and California of many of the best types of dates has led to a greatly increased interest in the possibilities of commercial date culture in this country. Because of the great cost of establishing a date orchard the Department has followed the policy of introducing and testing at its own gardens in advance of general distribution the best varieties of dates from the Old-World deserts, so that growers may be accurately advised as to the varieties most likely to succeed in specific localities. At the same time, in order to familiarize growers with the cultivation and care of the trees and the harvesting of the fruit, many thousands of seeds of the best varieties of dates have been distributed. New methods of propagation are being worked out to permit of the rapid dissemination of these new varieties in the regions to which they are adapted.

FIG CULTURE.—The United States now produces annually only about 200 tons of Smyrna figs, while 2,000 tons of that type are imported.

The finest types of the Smyrna fig are produced in the Meander Valley in Asia Minor. Investigations have shown that in California the foothills of the Sierra Nevada Mountains bordering on the San Joaquin and Sacramento valleys on the east form just such a region as the Meander Valley, though vastly larger in extent. It is confidently believed that somewhere in this warm foothill belt will be found the best fig region in this country. In order to demonstrate this at as early a date as possible, the Department leased a seedling-fig orchard at Loomis, Cal., situated some 400 feet above the valley floor. This orchard was planted some twenty-five years ago with seed of the best Smyrna figs. About half of the seedlings produced there are good edible varieties, the other half being caprifigs. From this collection the Department has distributed to growers in the foothills and cool coastal valleys a special collection of Smyrna figs, with appropriate caprifigs. It is believed that within three years it will be possible to determine definitely the localities best suited to the production of figs of the highest quality.

STUDIES IN BLUEBERRY CULTURE.

In the annual reports for 1908 and 1909 reference was made to experiments on the domestication of the blueberry. A publication has since been issued describing the principles of culture of these peculiar plants and showing the reasons for failure in most of the early attempts to grow them. The propagation of selected plants by cuttings and other methods has also been accomplished, and there is every prospect that effective methods of field culture will be developed and that selected varieties having fruits of large size

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and other desirable qualities can be grown. Experiments are now in progress with a variety bearing berries more than half an inch in diameter.

FIELD INVESTIGATIONS IN POMOLOGY.

FRUIT MARKETING, TRANSPORTATION, AND STORAGE INVESTIGATIONS.—These investigations have related primarily to the handling of table grapes, lemons, and apples in California, oranges in Florida, and peaches in Georgia, the object being to ascertain the causes of loss through decay of fruit in transit; to determine methods of handling it which will reduce the loss to a minimum; and to secure information relative to the proper methods of caring for it prior to and during storage. In the transportation work in California and Florida, the behavior in transit of grapes, lemons, and oranges handled under the prevailing commercial conditions was contrasted with fruit so carefully handled that injury to individual fruits was reduced to a minimum. The results in practically every case emphasized the fact that loss in general is proportionate to the amount of injury that the fruit receives prior to or during packing.

The special peach problem considered in Georgia was the influence during and after transit of cooling the fruit to a relatively low temperature before shipping. Rather marked results favoring such treatment were obtained.

In connection with the transportation tests made under different conditions, a large number of supplementary experiments, including the effect of washing lemons, were conducted in various packing houses.

In 46 experiments with lemons in 15 California packing houses in 1910, commercially handled washed fruit developed the greatest amount of blue mold, commercially handled fruit not washed ranked second, carefully handled lemons third, while carefully handled unwashed lemons developed the least injury.

The results of the experimental shipments of lemons from California to Washington, D. C., contrasting the behavior of carefully graded and packed fruit with fruit handled under commercial conditions, show that less than one-half as much blue mold developed in the former as in the latter.

There is a wide difference in the amount of decay in fruit shipped by packing houses employing different methods of handling the fruit. Lemons packed in California by eight packing houses where careful methods prevailed developed less than one-tenth as much blue mold as fruit packed by eight houses under careless conditions.

Considerable demonstrational and instructional work has been done incidentally by the men engaged in these investigations, resulting in one locality in Florida in less than one-fourth as much decay after as before instruction.

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Storage investigations were carried on in California with grapes, lemons, and apples. Different problems were involved with each of these fruits. The results indicate that the present market season of grapes may be materially extended if the fruit is packed in a "filler" before storing. Redwood sawdust has proved the most effective material thus far tried; but its use is attended with some objectionable features, owing to the very fine dust particles adhering to the fruit. The investigations further showed that 40° F. is the minimum temperature at which lemons should be stored, with a possibility of better results at an even higher temperature, and that "internal browning" in storage of apples grown in the Pajaro Valley is less serious in fruit stored at 35° than at 32° F. It is still less at a temperature of 37° F.; but the ripening processes are too active at this temperature for satisfactory results otherwise. The fruit stored at 32° F. possessed the best external appearance.

VITICULTURAL INVESTIGATIONS.—The eleven experimental vineyards established in different sections of California are now yielding important results with regard to varietal adaptations to different soil types and diverse climatic conditions, congeniality of Vinifera varieties on resistant stocks. and the value of a large number of direct producers.

Material progress has been made in the investigation of the Rotundifolia group of grapes, especially with regard to varieties and methods of pruning and training.

Investigations in the Middle Atlantic States have demonstrated that with the application of proper methods grape culture in this region may again be made as successful as it was in former years.

FRUIT-DISTRICT INVESTIGATIONS.—In connection with the fruit-district work the study of the adaptability of fruit varieties to the Ozark region has been completed during the past year and considerably extended in certain sections of Oklahoma, Kansas, Nebraska, and the central and southern Great Plains area.

GREENHOUSES, GARDENS AND GROUNDS.

The gardens and grounds of the Department have continued under the care of the Bureau of Plant Industry. A gradual readjustment of the grounds to meet the changes incident to the erection of new buildings and the removal of older structures has been made. The greenhouse equipment has been somewhat enlarged and now affords increased facilities for pathological work and for plant quarantine, which have been very much needed in connection with the research work of the Bureau. The removal of the last of the old greenhouses has resulted in marked improvement of the appearance of the Department grounds.

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PROGRESS IN PLANT INTRODUCTION.

The possibilities which lie in the introduction of the wild relatives of cultivated plants and in the breeding of them with well-known domesticated forms have become apparent to a wide circle of official and private experimenters throughout the country. In order to meet the demand for these wild plants, which in themselves are little more than curiosities, a world search is being carried on by hundreds of correspondents of the Office of Foreign Seed and Plant Introduction. The time required to secure and place in the hands of an experimenter some foreign species of plant which he wishes to hybridize is rapidly being reduced to a negligible quantity, and the stimulus afforded in the creation of new varieties suited to peculiar local conditions is of great and lasting benefit.

The search which was made in northern China three years ago for the original wild peach resulted in the discovery of a new form of peach (*Amygdalus davidiana*) which for hardiness in Iowa, at least, exceeds anything yet grown there. There are two strains, and both have proved much hardier than the peaches grown at this limit of the peach belt. At the same time this Chinese peach, which is used by the Celestials as a stock on which to graft all of their stone fruits, bids fair to prove a drought-resistant stock for the peach growers of the Southwest. Extensive experiments are under way to test more thoroughly this important stock for stone fruits.

Ten acres of Japanese timber bamboo are now growing at Brooksville, Fla., as a result of the introduction of more than 3,000 young plants from Japan, while a similar but smaller area is located at Avery Island, La. This is the first serious attempt in this country to test on a commercial scale the culture of a plant which in the Orient forms one of the best paying crops.

The mango industry of Florida and Porto Rico has reached a stage when the demand for grafted plants of imported varieties is much greater than can be supplied by the Department, and several thousand seeds have been ordered for propagation purposes. One single tree of an imported variety produced this season 428 fruits, and the fancy-fruit dealers of New York have pronounced these imported mangos worthy of commanding the highest prices.

The unusual interest attached to the discovery of the wild drought-resistant wheat in Palestine mentioned in the last report made it advisable to send an expert in acclimatization to inspect on the slopes of Mount Hermon this new prototype of the great cultivated cereal and secure data and material which will aid in the future study of its possibilities for dry-land conditions. This investigation is still in progress.

An agricultural explorer of the Department has spent the year exploring the plant resources of southwestern Asia and, although meet-

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ing with many unexpected difficulties, has pushed his way into Chinese Turkestan. Among the large number of interesting things he has secured is a variety of alfalfa from Erivan which is said to be longer lived than the Turkestan variety experimented with in the Caucasus; a species of Medicago from an altitude of over 4,000 feet, which is already being utilized in the work of creating new hybrid alfalfas for the Northwest; a wild almond from the Zarafshan Valley, found growing on the dry mountain sides at an altitude of 6,000 feet, which may prove to be a desirable stock for stone fruits; a drought-resistant cherry for home gardens in the Northwest and for use as a dwarfing stock, from the mountains near Samarkand; a collection of apricots with sweet kernels from the same region; the Afghasian apple and special varieties of pears for trial in the Gulf States; some remarkably hardy olives which have withstood zero temperatures and still borne good crops of fruit; late and early varieties of Caucasian peaches for trial in the Southwest; seeds collected in the Caucasus from wild plants of the true Paradise apple, which is used as a dwarfing stock, for the purpose of obtaining seedlings not infested with crown-gall; scions of a newly produced crab apple, reported to be a better keeper than American crab apples; the Slew Abrikose, a variety of apricot with a skin as smooth as that of a nectarine; seed of the Karakatch tree, a Turkestan elm, for the hot, dry sections of the United States; a remarkable drought-resistant poplar for the Middle West; a wild strawberry, fruiting at the end of February on the dry calcareous cliffs of the Caucasus, of possible use to strawberry breeders; a collection of hardy table-grape varieties from the Caucasus, some of which are reported to possess very unusual keeping qualities; and varieties of Asia Minor wheat and a collection of cereals from the oases of Samarkand, Old Bokhara, and Merv.

Two tons of roots of the edible aroids were harvested in South Carolina as a result of an experiment with these wet-land root crops, which seem to thrive well where the potato can be grown only with difficulty, and a much more extensive experiment in the growing and marketing of these important crops is under way.

The hardy yellow-flowered alfalfas which were obtained from central Asia have already been crossed with the hardiest of the blue-flowered forms, and the resulting crosses have proved their unusual hardiness and are now being investigated to determine their value to the farmers of the Northwest.

The popularity of a newly introduced Japanese salad plant and vegetable called udo has reached the stage when one of the largest asparagus growers in the country contemplates testing it on a considerable scale with a view to placing it on the market.

The fruiting at various points in the Southern States of the Chinese wood-oil tree, from the nuts of which the best drying oil is expressed,

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has made it advisable to set out in Louisiana a test orchard of an acre to determine its commercial possibilities.

The call for young trees of the seedless Chinese persimmon which was fruited in North Carolina last year was so great that special arrangements for the propagation of this variety had to be made, one firm desiring to put in 10 acres of this new sort even before it was fully tested by the experts of the Department.

The imported large-fruited jujubes, which form a very important orchard industry in China, the preserved fruits comparing favorably with dates, have shown themselves adapted to the arid climate of the Southwest, and extensive trials will be undertaken in California and in Texas.

INVESTIGATIONS IN FARM MANAGEMENT.

The Department has continued its study of the methods and practices of successful farmers, giving special attention to those types of farming which have maintained productiveness over a long period of years. At the same time it has been carrying to the farmer in a practical way many of the scientific facts brought out in its research investigations. Much of the demonstration work is being carried on in close cooperation with the state agricultural colleges and experiment stations.

SOUTHERN FARM MANAGEMENT.—In the farm-management demonstration work in the Southern States emphasis has been placed on the importance of winter legumes as a means of putting humus into the soil and preventing leaching and soil washing and as hay crops in a more diversified type of farming. A phase of this work is the teaching of farmers to grow their own supply of seed of these legumes. In certain parts of the South, where the area of cotton has been cut down because of the ravages of the boll weevil, farmers have been encouraged to grow soy beans as a possible substitute for cotton seed in the production of oil. The same machines that are used for extracting cotton-seed oil can be employed for extracting the oil from soy beans. The vines and the cake residue are also valuable stock feeds. Cropping systems have been devised for southern farmers entering upon some kind of live-stock farming. Many of the industrial schools of the South are giving attention to farming. The Department is cooperating with these institutions in devising plans of management which shall teach correct principles of crop rotation, tillage, and fertilizing.

NORTHERN FARM MANAGEMENT.—In addition to the study of farm practice throughout the Northern States, the attempt has been made to assist individual farmers, where located in typical sections, in planning their farm operations. In Maine personal work in demonstrating the method and value of the home mixing of

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commercial fertilizers was taken up with more than 1,200 farmers. It has been shown that good crops of potatoes, clover, and corn can be grown on some of the agriculturally abandoned hill lands of southern New York if attention is given to better strains of seed, more thorough tillage, and in many instances the use of lime. In northern Michigan, Wisconsin, and Minnesota are extensive areas of comparatively cheap cut-over hardwood and pine lands, varying greatly in quality and requiring distinctly varying types of farming for the greatest success. These types are being worked out and vary from dairying and hay farming on the heavier soils to the growing of seed crops, such as clover, hairy vetch, and rye, on the lighter soils. An agricultural survey of Iowa, showing the types of farming prevailing in each section of the State and the main agricultural problems needing attention, has been completed. In Missouri a farm-management organization of 200 farmers from all over the State is attempting to revise the systems of farming there along improved lines suggested by the Department.

WESTERN FARM MANAGEMENT.—Nowhere is the study of farm experience of greater importance than in the West, where farming is different from anywhere else in the United States. Each farm is in a sense an experiment station, and the experiences of the individual farmers are of great importance in formulating wise plans of farming. Satisfactory cropping systems and farm methods have been worked out for parts of western Kansas, Nebraska, and eastern Colorado. The recommendations of the Bureau on tillage practices in the upper Columbia River Basin have been widely adopted.

FARM ORGANIZATION AND OPERATION.—The man and labor hours required to grow farm crops and do all kinds of farm work are being studied in detail on more than 100 farms. The records thus secured show just what it costs to produce a quart of milk, a bushel of corn, a colt of definite age, and the like. These data will later become the basis for determining the profits of various farm enterprises under widely varying conditions. In New Hampshire a farm-to-farm survey of four townships was made to study the relation of profits to the type of farming followed. The results bring out strongly the important places occupied by fruit and poultry on the farm. Studies have been made of farm investments and of the details of machinery and tools required in different types of farming. It has been found that usually only about one-half the capital invested in farming is in the land, the remainder being in building equipment, tools, and live stock. Not infrequently men buying farms put all their money into the land and then struggle for years with inadequate working capital to make a living, whereas if a judicious division of the investment at the outset had been made a much more productive and profitable plant would have resulted.

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PRICKLY-PEAR INVESTIGATIONS.—The past severe winter has shown that the spineless forms of prickly pear must be confined to regions even farther south than was previously announced. This is particularly true in the regions from Texas to Florida. Investigations indicate, contrary to general belief, that prickly pears breed true to seed. The spiny species native to southern Texas are giving great promise as a cultivated farm crop. Thousands of cattle have been "roughed" through on this feed the past year, and several dairies have depended on it alone for their roughage. Both dairy cows and other cattle do well with no other roughage.

WEEDS AND TILLAGE.—Methods of eradicating quack-grass, or witch-grass; perennial morning-glory, or bindweed; and wild onions have been worked out on the basis of their agronomic habits, and extensive demonstrations are in progress to bring these facts home to farmers in different parts of the country. Work on the relation of weeds to the tillage needs of corn is being continued on 160 farms in 32 States. Results of this work to date seem to indicate that the primary object of corn tillage is the destruction of weeds.

FARM PRACTICE.—The possibility of curing hay by artificial drying has been shown to be practicable for regions like the South, where it is difficult to cure hay because of untimely rainfall. A drier that cures green alfalfa in 25 minutes into a very superior hay at a nominal cost has been designed and constructed by the Department. The study of farm practice in the use of commercial fertilizers has resulted in the publication of a Farmers' Bulletin dealing with this subject in the South. Studies of pastures have shown their growing importance in the production of cheap beef. The run-down condition of pastures in many sections is being studied with special reference to their rejuvenation. In the clearing up of logged-off land, promising new methods for burning stumps which appear to be cheaper than the use of powder and the donkey engine, although slower, have been devised.

FARMERS' COOPERATIVE DEMONSTRATION WORK.

The demonstration work among southern farmers is rapidly increasing. Organized in 1904 for the purpose of fighting the boll weevil in Texas, this work has now extended to all of the Southern States.

The problem of meeting the advance of the weevil in the South is a complex one. Southern farmers for years have raised cotton and depended upon it to furnish home necessities and supplies. A credit system has prevailed under which the cotton farmer, whether owner or tenant, runs twelve months behind. When cotton fails, his credit fails; hence the necessity for a change of methods.

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When the boll weevil came, bankers and business men lost confidence and extensive local panics resulted. With his cash crop cut off the necessary food crops for man and stock had to be grown on the farm. It was necessary to teach and demonstrate diversification of crops in order that the farmers might be able to raise cotton at a profit and in sufficient quantities to meet the world's demands, and the Department has undertaken to show how to produce paying crops even where the weevils are numerous.

The leading features of this work are (1) the adaptation of modern cultural methods to the raising of cotton under boll-weevil infestation and (2) the teaching of modern farm methods by which other standard crops can be produced for the purpose of furnishing food for the family and feed for the stock. These things must be done on the farmer's own land and with his cooperation.

From 1904 to 1909 there was an increase from 1 to 362 agents in the field. The number has now reached 450, and the demand for more is urgent. More than 75,000 farmers are receiving direct instruction on their farms. This work has greatly increased the supply of humus and the use of legumes in soils wasted by long-continued cultivation in cotton. It has caused lands to be plowed deeper from year to year and seed beds to be more thoroughly prepared. Cultivation is becoming more intensive, seed selection of both corn and cotton more general, and farming, as a rule, more profitable.

In 1909 figures from a large number of demonstrators showed a comparative increase of from 50 to 400 per cent in the average yield of standard crops, and the figures for 1910 indicate similar results.

One of the striking features of the work of 1909 and 1910 is that in thousands of cases an average crop of cotton has been made in spite of the weevil by following the directions of the Department, whereas others in the same localities who have not carried out these instructions have failed to make a crop. This is conspicuously true in the alluvial sections of Texas, Louisiana, and Mississippi. The methods advocated are being rapidly adopted by farmers in boll-weevil-infested territory and are fast being recognized as the best means yet presented of raising a crop of cotton in spite of the boll weevil. This means the restoration of confidence and credit and prevents the abandonment of farms and the emigration of labor to other fields.

Private citizens, business men's organizations, bankers' associations, county boards, and others in many of the Southern States have been of considerable assistance to the Department in extending the work.

It has been found by experience that the only way to reach some farmers and to get them to follow better methods of farming is through

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their boys. Where a farmer's boy has been enlisted in a corn club and produced on his father's farm an acre of corn yielding from 50 to 200 bushels at a cost of not more than 30 cents a bushel, the farmer is no longer skeptical about improved farm methods.

In 1909 there were 10,543 boys enrolled in these clubs. In 1910 the number has increased to 46,225. This feature of the work has aroused unbounded interest and enthusiasm and turned attention toward the farm. Public-spirited citizens in the various Southern States have contributed $40,000 for prizes for these boys. Prize winners in four States were given trips to Washington and awarded diplomas of merit. This year such trips are offered from every Southern State through bankers' associations, boards of trade, educational associations, private citizens, and state fairs. Governors and superintendents of public instruction will give diplomas similar to those earned last year to all boys who make excellent records.

When a boy makes a thorough study of corn it is easier to succeed with other crops. Some of the boys in the boll-weevil parishes of Louisiana have not only broken the records in corn production there but have achieved the same extraordinary results with cotton, potatoes, onions, and other crops.

Marked changes in general farm methods and in the economic life of the people do not take place in a single year. The few demonstrations in each neighborhood the first year attract attention and dispel doubt, the second year brings increasing success, and the third year usually marks the beginning of the general adoption of the changed methods, though time is required to make the adoption universal and thorough in a community.

Special work is done in advance of the weevil to prepare the farmers to meet the new conditions. During the seasons of 1910 and 1911 this effort is being and will be exerted within a few hundred miles of that great semicircular line which marks the boll weevil's advance, and it is hoped that the panic and business depression usually accompanying the invasion of the weevil will thus be avoided.

PROGRESS IN FORAGE-CROP INVESTIGATIONS.

BREEDING IMPROVED FORAGE CROPS.—For most of the farming areas of the country experience and much experimenting have determined the most valuable forage crops. Thus, timothy and red clover are of paramount importance in the northern part of the country and alfalfa in the West, while in the South among the several forage crops used cowpeas are perhaps of highest value. Each of these crops consists of numerous varieties and strains, some of much higher value than others. The isolating of the best strains by selection and the combining of the good features of two or more varieties by hybridizing have already yielded valuable results, and extensive work of this kind is now being prosecuted.

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In the case of cowpeas upward of 200 varieties from all parts of the world have been secured and tested. Among those of prime importance to the breeder are the Iron, on account of its disease resistance; the Whippoorwill and New Era, on account of their excellent habits and prolificness; and certain East Indian varieties which are tall and bushy in habit and bear abundant pods with small, hard seeds decidedly resistant to weevil attack. These sorts have been hybridized, and among the progeny are varieties which in excellence of habit, disease resistance, and prolificness combined surpass any of their parents. There is every reason to believe that these improved sorts, which can be readily harvested by machinery, will replace in a large measure those now grown.

In cooperation with the Ohio experiment station the breeding of timothy on an extensive scale has been undertaken at New London, Ohio. The recent introduction and rapid spread of timothy rust have made it necessary to breed for resistance to this disease, as many of the strains previously developed are highly susceptible. It appears that timothy breeding must be in the main comparatively local; at least, strains bred in the East have not proved superior in the West, and vice versa.

Improved alfalfas are mostly needed in the colder States, where great hardiness is essential, and in the Eastern States, where strains that will produce seed under humid conditions and thus become completely adapted are desired. Better seed-producing strains, especially for dry-land farming, are also important. From the progress already made there can be little doubt that all these ideals can be secured. Some of the hybrids between the yellow Siberian alfalfas recently obtained by our agricultural explorers and the hardiest ordinary alfalfas possess excellent habits and great cold resistance, so that the menace of winterkilling is now greatly reduced.

Every year an enormous quantity of alfalfa seed is imported from Europe, and this has been increasing in recent years. Not only should the United States grow all the alfalfa seed it needs, but a surplus for export should be produced. Splendid yields have been secured by growing alfalfa for seed in cultivated rows on dry lands in the semiarid regions. Strains selected for high seed production have given noteworthy returns in such experiments.

Red clover is a crop of great variability with which little successful breeding work has been accomplished. In the Old World there are several well-defined geographical varieties, none of which, however, have shown superiority in this country over the ordinary American seed. The breeding of this crop presents two types of problems: (1) In the States where ordinary clover succeeds well increased yields can almost certainly be obtained by selecting and breeding

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individuals which have greater inherent vigor, and (2) in many places it is now difficult to grow red clover on land where it once grew well. This difficulty is commonly referred to as due to "clover-sick" land. The trouble is very obscure, but in some cases is apparently caused by a specific disease and in others by a complex of diseases. In northern Alabama a farmer has grown a selected clover successfully for seventeen years or more on land where ordinary clover failed. This success was obtained by saving the seed of the surviving plants until a strain was established that succeeds perfectly. Apparently this strain differs little from that bred by Professors Bain and Essary, of the Tennessee Agricultural Experiment Station, for resistance to a stem disease which seems to be the principal enemy of clover in that State. The importance of the red-clover crop is such that extensive breeding work of this sort is being prosecuted.

NEW FORAGE CROPS.—Many new forage crops from all parts of the world are being tested each year. Only a few of these possess sufficient value to compete with the crops now grown. In a few cases, however, these introductions prove to be of striking value. At least four such plants recently introduced have given such admirable results that there can be little question that they will prove of great value.

Rhodes grass, while not entirely a new grass, has been heretofore tested mainly in the arid regions, where it is not sufficiently hardy to withstand the winters. The experience of the last three years has shown that this grass is especially adapted to the Gulf Coast region, particularly to Florida and southern Texas, where it not only withstands the winter, but grows continuously. In southern Florida three cuttings have been made during the winter months, and as many as six during the entire season. This grass has fine, upright stems and good seed habits, so there is no reason why it may not be employed as extensively as a meadow grass in the region to which it is adapted as timothy is in the North.

Sudan grass is a close relative of Johnson grass, but lacks entirely the rootstocks which make Johnson grass so objectionable as a weed. Sudan grass is a true bunch-grass, after the manner of timothy, and is just as easily handled. It grows taller than ordinary Johnson grass, is very leafy, and produces splendid crops of seed. Depending on the rainfall, it can be cut from two to three times in a season.

Additional experience has verified the high estimate originally placed upon the Yokohama bean. It is really an early velvet bean which will mature its seeds as far north as Virginia and Kentucky and will give all the intervening States a crop as valuable as the Florida velvet bean is in Florida. This variety is unusually fruitful and in the southernmost States will produce two crops of seed in a year.

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It will doubtless come into extensive use both as a soil-improving crop and for forage. Hybrids between it and the Florida velvet bean and the Lyon bean are of special promise.

During the exceptional drought of the past season in north-central Texas the interesting fact developed that pink kafir is decidedly more drought resistant than milo or Blackhull kafir. Under conditions that caused the latter to "fire" badly, the pink kafir remained perfectly green.

The need of better forage crops is perhaps felt mostly in the semi-arid regions. Extended search is still being made throughout Asia in the hope of finding more valuable grasses and legumes adapted to these regions. Some of the legumes from the drier portions of India, like kulthi (*Dolichos biflorus*) and the bonavist (*Dolichos lablab*), have demonstrated their ability to withstand drought under which cowpeas suffer severely, and it is not unlikely that these two plants may come to be largely grown. This will depend mainly on their ability to produce satisfactory crops of seed. Some of the new millets from the interior of Asia, especially the Kursk millet obtained in 1899 and the Turkestan millet secured in 1906, are likely to replace the other varieties. The Kursk millet can be grown as far north as the Canadian line, but the Turkestan is a later variety which matures only in the central and southern portions of the Great Plains region.

CONGRESSIONAL SEED DISTRIBUTION.

The distribution of seeds and plants upon Congressional order has continued along much the same lines as in the preceding year. The demand for vegetable and flower seeds proved greater than ever before. Certain changes in the method of mailing packeted seeds have obviated the necessity for rehandling by the postal authorities in the Washington City post-office, thereby reducing the labor and facilitating the mailing of the seeds. The packeting, assembling, and mailing have been satisfactorily done under contract.

In connection with the seed distribution, an effort to propagate Dutch bulbs successfully has been continued with encouraging results. Climatic conditions in the Puget Sound region, where the work is being done, appear to be favorable, and it is hoped that a sufficient quantity can eventually be produced to furnish the supply used for Congressional distribution.

FOREST SERVICE.

In my report of last year I estimated the total stand of merchantable timber on the National Forests, exclusive of those in Alaska, at about 400 billion board feet. Revised and more accurate estimates of this stand, obtained during the past year, indicate a total on the Forests of the continental United States of about 530 billion board

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feet. Though the aggregate is so great it shows a low average stand—under 4,000 board feet per acre. It is true that a considerable acreage of National Forest land lies so high that it will never furnish much merchantable timber, and that much other land is too arid to grow such timber, although it supports a protective cover which must be maintained for the sake of its influence upon water supplies.

The cutting which now takes place does not offset the increase. Even the exceptional fires of the summer of 1910—fires due to such an extraordinary combination of natural conditions—hardly wiped out the increment of the year.

NATURAL AND ARTIFICIAL REFORESTATION.

Where it may be a matter of waiting for centuries if the forest were to be left to accomplish its own return to the areas from which it has been completely dislodged, artificial reforestation must be, and is being, undertaken at once. The work, hitherto mainly experimental, is now entering on what promises to be a practical and successful stage; extensive experimentation must nevertheless be continued, along with practical work where the means of making this a success have been found, in order that the field which lies open may be covered in every part.

Especially encouraging has been the progress made with direct sowing of the Forests. Not only have a large number of methods been given experimental test, but also definite and valuable results have been obtained in some regions. Over 9,000 acres in all were sown during the year, while some planting or sowing was done on practically every National Forest. The work will continue during the present year on a much larger scale.

Reforestation must follow lumbering as well as fire if the Forests are to be both permanent and fully useful. The methods of cutting employed by the Forest Service are always planned with especial reference to bringing about such reproduction as is desired. The natural reforestation which can be obtained through lumbering when the latter is made a means of applying forestry has many advantages over the natural reforestation already described as taking place on the burned areas of the Forests. Instead of having large areas on which there are no seed trees, careful selection and reservation is made of trees so spaced and situated as to insure ample seed distribution wherever room is opened for new growth. Instead of having a substitution of valueless or inferior trees for those most valuable, the cuttings are planned with reference to removing from the forest, so far as possible, undesirable species.

The work of reforestation is so important that I consider it justifies and demands immediate provision for pushing it forward, and I

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therefore purpose to ask from Congress an increase of $180,000 in the funds available for it.

The fact that reforestation is to be brought about partly by the actual outlay of money for sowing and planting, partly by permitting the forest to sow itself and protecting the young growth from fire after it has become established, reenforces the statement that National Forest administration means, for one thing, an increase in the investment. Expenditures for artificial reforestation are obviously investments. It is just as obviously immaterial by what methods the new stock is established, so long as it is obtained. Whether hand-sown or tree-sown, if it is growing it represents an increase of capital account. It is worth remembering that only a part of the yearly cost of National Forest administration and protection goes to pay for the transaction of current business. Another part is spent to protect the existing stand of merchantable timber and young growth, while a third part is laid out in providing more material for a future cut through natural and artificial replacement.

PERMANENT IMPROVEMENTS AND FIRE PROTECTION.

For the last four years Congress has made a specific appropriation for the construction and maintenance of permanent improvements on the National Forests. The amount thus appropriated for the year 1910 was $600,000. Of this, something less than $60,000 was spent for maintenance of improvements. The experience of the past summer proved conclusively how valuable these improvements are and how great is the need that they should be multiplied.

During the past season there have been unusually severe forest fires in nearly every part of the country. The National Forests have suffered to a greater extent than at any time since their establishment. When the National Forests were placed under administration, the annual fires were reduced to a small percentage of what previously occurred. In 1906 the fires burned over about 115,000 acres, or about one-tenth of 1 per cent of the total area. In 1909, with a much larger total of Forests, the area burned was 362,014 acres, or something less than two-tenths of 1 per cent of the total. During the past season, under the difficulties of an unprecedented drought, the protective force was unable to prevent a large number of fires from starting, and many of these could not be extinguished before a great loss had been sustained.

The fires of 1910 were primarily due to a severe drought, which extended throughout the country and which in the Northwest was the most severe ever known, so far as official records show. The spring was very dry, and in the summer, when there are usually abundant rains in the mountains, the rainfall was exceedingly small and very localized. The region most affected was the area drained

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by the Columbia River, extending from the ocean to western Wyoming and Montana. In most places there was practically no rainfall at all during July and August.

The effect of the drought was to render the forests very inflammable. Not only did the surface litter of leaves, branches, fallen logs, and other material become very dry, but the thick layer of vegetable mold in the deep, usually moist forests became like tinder.

In addition to the drought, the past season was characterized in many places by constant high winds, which rendered fire protection exceptionally difficult. The smallest escaping spark from a camp fire or burning slash pile was often enough to start a blaze, which, under the high winds, developed into a dangerous conflagration in an incredibly short time.

The most severe drought was in the Northwest, and there also were the greatest and most disastrous fires. The worst fires occurred in northwestern Montana and Idaho and in eastern Oregon and Washington. Severe fires occurred in California and the central Rocky Mountain region, but the conditions were not as difficult as in the North Pacific region and the fires were more easily controlled.

In the Northwest the fires began to be numerous in June. During July they increased very rapidly, reaching their climax during the last half of August. The Forest officers were ordered to increase their patrol and use every measure to extinguish the flames. With the increase of the fires, it soon became apparent that the special fund appropriated by Congress was entirely inadequate to meet the situation. Numerous fires were then burning in the Forests and every day new ones were reported. The entire forests of the northern Rocky Mountains were at one time threatened with destruction. Unless the fires had been checked scores of towns and communities would have been wiped out and the lives and homes of thousands of people imperiled. I was confronted with the problem of either putting out the fires or being directly responsible for what would have been one of the worst disasters in the history of the country. Without hesitation I called upon the Forest officers to stop the fires and to make such expenditures as seemed absolutely necessary to accomplish this result. Every source of help was called in. Temporary labor was employed where it could be secured. The War Department aided by sending troops. The railroad companies, lumber companies, and private individuals cooperated in the endeavor to avert a great disaster.

Early in September the flames were finally subdued. The fires which could be reached by roads and trails were largely put out through the crews working under the Forest officers. Those fires in the inaccessible areas were extinguished finally by the aid of timely rain and snow storms. While the aggregate loss of life and property was large and the cost of fighting the fires about a million dollars, I do

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not hesitate to state that if it had not been for the heroic and efficient work of the Forest officers, many millions of dollars' worth of public and private property would have been destroyed, and probably many lives would have been lost. I can not commend too highly the self-sacrificing work of the local Forest officers, who toiled day and night, week after week, risking their lives to save the Forests.

The reports show that there were over 4,000 fires in the National Forests during the season. Most of them were small and were promptly extinguished by the Forest officers. Only about 15 per cent of the fires were responsible for the great losses. These occurred chiefly in the inaccessible regions where they could not be reached quickly because of the lack of roads and trails, or in areas inadequately patrolled. The greatest damage was done by the great fire of August 20 in northern Idaho. Many fires were burning at that time, but nearly all of them were under control, and would shortly have been extinguished had it not been for a terrific hurricane which developed and swept all fires beyond control. Within twenty-four hours there was practically a continuous fire for a distance of over 100 miles.

The total area burned over during the season amounts to over 3,000,000 acres. While accurate data have not yet been received from all the Forests, it is probable that between 6 and 7 billion feet of timber was killed. A portion of this can still be cut and utilized, so that it will not be a total loss. The damage in money can not be accurately estimated until forest surveys are made, but it will probably reach over $25,000,000 if both merchantable timber and young growth are considered.

The cost of fighting the fires will aggregate a little over a million dollars. This is a large sum, but it represents considerably less than 1 per cent of the value of the property saved.

It is to be deeply regretted that there was a large loss of life through these fires. Altogether 76 persons in the employ of the Forest Service were killed in fighting the fires. All of these men were temporary employees. That more were not killed was due to the skill and coolness of the forest rangers. Where relatives were found, the bodies were brought out and every help possible given to the families. There were 35 persons killed whose relatives could not be located.

There were a number of men injured more or less seriously. Unfortunately the law does not permit paying the expenses of the injured or their wages after they ceased their work. The hospital expenses of these men were met by private subscription. The Red Cross contributed $1,000. The remaining expenses, including expenses of interment of the dead, were borne by subscriptions from the Forest officers and other members of the Forest Service.

The chief causes of the fires are locomotives, lightning, carelessness in burning slashings, and incendiarism.

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Railroads continue to be responsible for a large number of fires. This will continue to be the case until the locomotives are either equipped with efficient spark arresters or oil is used for fuel. It should be said, however, to the credit of the railroads, that during the past season many of them have taken an active part in assisting in the work of fire protection and fire fighting. The Chicago, Milwaukee and Puget Sound Railroad has installed oil-burning locomotives, and it is a striking fact that not a single fire has started from them, although the road traverses a long distance in the National Forests. A number of railroad companies have entered into cooperative agreements with the Forest Service to clear fire lines along the right of way and to employ special guards to patrol the tracks during the dangerous season. The effectiveness of the cooperative patrol by the railroads and the Forest Service was well illustrated in Montana and Idaho. Although a very large number of fires were started, most of them were extinguished before great damage was done. In some instances, however, no effective system of protection had been undertaken and very damaging fires are chargeable to locomotive sparks.

One of the most prolific sources of fire and one which is uncontrollable is lightning. There are scattered throughout the forest innumerable dead trees and stubs. During the past season there were many electric storms unaccompanied by rain. In nearly every such storm some tree was struck and a fire started. These occurred frequently in very remote and inaccessible places and resulted in fires which were very disastrous because they could not be quickly reached.

Many fires are chargeable to carelessness, especially in leaving camp fires and in burning slashings. A larger patrol service would prevent to some extent carelessness in the use of fire in the woods, but fundamentally there is required a better appreciation on the part of the public of the need of protection from fire.

The most regrettable fact is that there has been a considerable amount of incendiarism. While it is very difficult to prove that a given fire is of incendiary origin, circumstantial evidence has shown that many incendiary fires were started during the past season. The situation has been so serious that I have offered a reward for the conviction of incendiaries.

The first necessity in organizing a forest for protection from fire is to construct roads and trails in order that the different parts of the forest may be accessible both for patrol and for the mobilization of fire fighters. A forest in which there are inadequate means of communication can not be fully protected under any conditions. Without trails it is impossible properly to patrol the forest, and in case a fire is discovered it can not be attacked if there are no means of transporting quickly to it men and fire-fighting equipment. The

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roads and trails serve also as an aid in attacking fires. The work of constructing roads and trails has been pushed as fast as available funds permitted. There have been so far built about 5,500 miles of roads and 16,000 miles of trails. Yet this is only a beginning when the extent of the Forests is taken into consideration.

In addition to roads and trails it is necessary to construct special fire lines. These are cleared lines through the woods located at critical points to supplement the system of roads and trails for fire protection. They serve both to check fires and also as points from which to fight them. Fire lines are being built as rapidly as possible. The most extensive work has been carried on in southern California, where the protection of the chaparral forests is of great importance in protecting the water supply. Fire lines are also extensively built along railroad rights of way and around lumber operations. The burning of broad fire lines here and there at critical points in open yellow pine forests has been undertaken and will be pushed with vigor.

A second necessity in the organization of the Forest is a proper equipment for the prevention of fires and for fighting such as may be started. The most essential primary equipment is a system of telephone lines connecting ranger headquarters and lookout stations. The purpose of the telephone is to enable rangers and guards to give quick notice of fires and to secure such assistance as is required. There are already many instances where millions of dollars' worth of Government timber has been saved through the use of such telephone lines as have already been built. The total amount so far constructed comprises about 9,200 miles. The Forests are still very meagerly equipped.

The Forests should be equipped also with lookout stations. These are usually located at high points from which it is possible to look over a large area. At these lookout stations there should be at least a small building equipped with a telephone. Frequently where it has not been possible to build telephone lines, the lookout stations are provided with the heliograph and other means for signaling. Where the country is flat, watchtowers are built.

An essential part of the equipment of a forest is a system of properly located and well-equipped ranger stations. Many instances have occurred during this season where fires which threatened enormous damage were promptly extinguished because there was a ranger stationed within striking distance.

The equipment of the National Forests should comprise also an ample supply of tools and other equipment necessary in fighting fires. A beginning has been made in the establishment of small equipment stations here and there along the roads and trails. These stations consist of small buildings or tool boxes containing such equipment

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as is necessary. Usually they contain axes, shovels, grub hoes, water buckets, water bags, ropes, etc. In some cases in remote sections there is also a certain quantity of provisions, grain, pack saddles, tents, etc.

In the more remote Forests, where travel must be largely by trail, it is necessary to have available pack horses to transport supplies and equipment. It is exceedingly difficult in most regions to secure horses at short notice. In the case of fire breaking out at a distant point it is necessary not only to transport a crew of fire fighters quickly but also to provide provisions for them. It is desirable, therefore, that the less accessible Forests be provided with pack trains with such equipment as is necessary to meet the requirements.

The danger of the recurrence of such disasters as that of last summer's fires should be reduced to a minimum. Though it was unpreventable under the conditions of the year, the day will come when it would be counted preventable, and when under similar conditions it would generally be prevented. This, however, can not be brought about in a single year, nor in five years. It must be brought about gradually by the upbuilding of a thoroughly organized system of forest management. High organization of this sort can be attained only step by step. It is no more possible under pioneer conditions than is a highly organized private industry. What is demanded now is that each year progress shall be made toward the ideal of completely adequate protection.

This means that each year, for one thing, the existing permanent improvements should be extended. Not to extend them as fast as opportunity is given would be criminal. The Forest Service is powerless to provide them except as means are put at its disposal. Expenditures for equipping the Forests with roads, trails, telephone lines, fire lines, and other improvements can be made only from the permanent improvement fund. In the years 1907 to 1911 Congress made available a total for this purpose of $1,975,000. The amount available in 1910 was $600,000; in the current year it is $275,000. There are now on file carefully considered plans for specific permanent improvements calling for an amount of work which the entire appropriation for the Forest Service last year would hardly have paid for. In view of the facts, I consider it my duty to ask for a substantial increase of the permanent improvement fund.

In every forest there is a certain amount of inflammable material on the ground. Not only is there an accumulation of vegetable matter on the surface of the ground, resulting from the annual fall of leaves, but in the old uncared-for forests there is also a large amount of fallen timber. In the virgin forests which have not been burned this dead timber represents the accumulation of many years. There are, however, many areas which have been burned over in the past

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and are now littered with trees which were killed by the fires. This dead timber constitutes a great menace to the forest. There is an immense amount of it, and there is no way of disposing of it at once. When timber is cut in the National Forests, the tops are piled and burned in order that there may be no further accumulation of such débris, and in such cuttings also the old material which is found on the ground is disposed of where it is at all practicable. Where it can be disposed of, dead timber is sold or given away to settlers. More than three-fourths of the total free-use cut of last year, which exceeded 100,000,000 feet, was dead timber.

The plan has frequently been suggested of burning over the surface of the ground every year or two in order to prevent the accumulation of inflammable material. The theory of this proposition is that if the surface is burned over early in the spring, before it becomes very dry, the inflammable material will be destroyed and any fire which subsequently may start will do comparatively little damage. Some have even gone so far as to assert that the burning of the forests by the Indians and early settlers was the proper way to protect them. As a matter of fact, these early fires were exceedingly destructive. Not only did they destroy enormous bodies of timber, but they killed young trees and prevented the reproduction of the forest. Moreover, the dead trees now standing and lying on the ground, which resulted directly from these early fires, to-day constitute a great menace to the forest. Any wholesale annual or periodic burning of the surface of the ground will result in putting a stop to forest growth. It is unthinkable that anyone should seriously advocate a system of handling public forests by which there is no provision for a future production of timber. It has been customary in portions of the Southeast to burn over the forests annually or periodically, and the ultimate result, as is already actually illustrated in a great many places, is the final destruction of the forest.

There are certain types of forests where annual or periodic burning of certain specified areas is feasible. An example is the open yellow pine forests of the Southwest. Carefully regulated burning of the surface is practicable in those areas where there is no young growth and the timber is sufficiently old to resist the fire. Most of the National Forests are composed of trees of all ages mingled together by individuals or groups. Annual or periodic burning over the surface in such forests would inevitably result in the death of the small trees and the prevention of new reproduction. The plan of burning the forest for protection is therefore not applicable in most of the National Forests. If the principle of surface burning is to be used, it is best applied in the open types of forest, to burning broad fire lines located here and there at well selected points. The whole surface should not be burned, but only wide lines about 100 to 200 feet wide. In

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this way there are firebreaks throughout the forest, and if a fire starts it may then be confined to a small area. The cost of the work is thus reduced and bodies of small growth are saved. Even this work requires a large annual expenditure, far more than is now available for the Department.

As the protection from fire is the most important consideration in the administration of the National Forests, I have requested an increased appropriation for this work. In addition to the increase requested for permanent improvement work, I urge that there be an increase of $120,000 for extra patrol, and that authority be granted to me to draw upon the receipts from the Forests, in case of grave emergency, for fighting fires.

NATIONAL FOREST TIMBER SALE POLICY.

It must always be kept in mind, as I pointed out in my report a year ago, that the National Forests form an investment which has not yet become fully productive. They are valuable chiefly for three great uses—water conservation, the production of forage, and the production of timber. The first use is already well developed, so far as concerns irrigation, though it will have much larger development in the future. But of the available water power on the Forests, estimated to be in the neighborhood of 15,000,000 horsepower, only the most insignificant fraction has as yet been harnessed. The forage-producing power of the Forests is generally utilized now; only in the most inaccessible mountain regions does the forage crop go to waste, and the increase of this resource must take place primarily through such improvement in present methods as will enable the areas now used to support a larger amount of stock than at present, rather than through increases in the grazing area. In striking contrast is the timber crop. Its harvesting is confined to a trifling part of the total. While the stockman occupies the length and breadth of the Forest range, the lumberman is operating only along the edges of the vast bodies of the National Forest timber which the slow centuries have ripened for the ax.

When the Forest Service first took charge of the National Forests, through their transfer from the Department of the Interior on February 1, 1905, in an effort to open them to use, timber sales were everywhere encouraged. Less than 114,000 feet of timber were sold during the fiscal year 1905, at an average stumpage price of 75 cents per thousand. In the fiscal year 1906 the amount sold rose to nearly 300,000 feet and the average stumpage price rose to $1.72 per thousand; while in 1907 the sales exceeded 1,000,000,000 feet, at an average stumpage price of $2.42 per thousand.

Since 1907 the totals of sales have been much smaller—in 1908 not much over one-third of the 1907 sales, in 1909 not much over

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one-fourth, and in 1910 something over one-half. This reduction was partly the result of the general business depression. The lumber cut of the entire country in 1908 and 1909 was considerably less than in 1907; and, since National Forest timber is on what may be called the fringe of the demand for stumpage, it naturally felt the effect of business disturbance to a much greater degree than did timber in more settled regions. But the reduction in sales was largely the consequence of a perception that, on grounds of broad public economy, the timber-sale policy of 1907 required modification.

Following the fires of last summer an abnormal period may be anticipated. As a result of those fires a great quantity of fire-killed timber is in the Forests. This timber must be utilized speedily if it is not to be a complete loss. It is the part of economy to have it lumbered, even though it has to be sold at a very low price, in order that the resulting product may take the place of what would ordinarily be sawed from green timber. In the regions where fire-killed timber is plentiful the cutting of any other material will so far as possible be suspended. Every effort will be made to find purchasers, large as well as small, and stumpage will be offered on very liberal terms. It is hoped that in this way the general and local markets may be led to absorb a large part of the manufactured product of the fire-killed timber in place of the supplies which would ordinarily be drawn from undamaged private and public holdings.

RANGE MANAGEMENT.

The total of live stock of all kinds which used the National Forest range in 1910 under pay permits fell off 2.75 per cent in comparison with the previous year. This is the first year since regulated grazing began that there has not been an increase. The cause of the drop is to be found in the reduction of available range through eliminations of land found to be better suited to other uses than to forest purposes. Since the lands excluded by these eliminations were relatively low-lying, open, and accessible, they were above the average in the amount of grazing use made of them.

Decided progress was made during the year toward working out methods of more intensive range use, and some of the methods which have been experimentally tested were taken up and applied by stockmen on their own holdings with good results.

Mention should be made also of the need of permanent improvements in the form of drift fences, watering places, and other accessories to the handling of stock, as a means of securing the fullest utilization of the forage crop of the Forests. To a considerable extent it has been found possible to secure such improvements through cooperation of the stockmen. The development of the range to its fullest usefulness requires, however, the investment of public money

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in permanent improvements just as truly as does the successful guardianship and promotion of use of the timber supply of the Forests.

The receipts from grazing were last year for the first time exceeded by the receipts from timber sales. In future years the present relative position of the receipts from these two sources is not likely to be reversed; on the contrary, from now on the receipts from timber may be expected to gain steadily upon the receipts from grazing.

FOREST PRODUCTS INVESTIGATIONS.

The work of the Forest Service for the public is not confined to applying the best methods of management to the use of the water, timber, and grazing resources of the National Forests. Study is also given, so far as is possible with the small part of the appropriation which can be devoted to work other than administrative, to all problems whose investigation promises to promote economy in the use of all that is produced by our Forests, private as well as public, or to increase their yield of valuable material. The investigations directed to this end comprise both investigations of Forest products and investigations in the field of general forestry.

An event of large importance was the completion and occupancy during the year of the Forest products laboratory provided at Madison, Wis., by the State of Wisconsin for the use of the Forest Service. The securing of this laboratory was brought about by the efforts of the authorities of the University of Wisconsin, in the belief that the advantage to the university of having the products investigative work centered in Madison would well repay the outlay. It is to the advantage of the Forest Service also that its laboratory is in close touch with the staff and work of such an institution as the University of Wisconsin.

The Madison laboratory equipment was furnished by the Government. The new building and the new equipment together provide the most effective plant for research into the problems which underlie the best use of Forest products to be found anywhere in the world. Many of these problems are of a highly technical character and can be attacked successfully only through the possession of such facilities as are now for the first time available. These problems include such matters as the strength and physical properties of the various kinds of woods in commercial use, or of woods which though not yet put to particular uses are inherently suitable for them; methods of seasoning, preserving, kiln-drying, and otherwise handling woods so as to secure from them the maximum service and a minimum of waste; the manufacture of wood pulp; methods of extracting, by distillation and otherwise, valuable wood products; and methods of

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utilizing sawmill and other waste, either for the extraction of by-products or for reworking into smaller wood forms.

Because of the opportunity which seems to me to be clearly open for advancing the interests of Forest preservation through the study of methods of getting longer or better service from given classes of material, the invention of improved processes of extracting wood products, and the saving of waste, I desire to provide for an expansion of the investigative work of the Forest Service along these lines, and have included in my estimates of appropriations needed for the year 1912 an increase of $72,000 over the appropriation for the current year to make such an expansion possible. I am confident that practical results are within reach which will richly repay the cost of seeking them.

OTHER INVESTIGATIONS.

In cooperation with various States studies of Forest resources and their industrial employment were continued. Such state cooperative studies have in view, from the standpoint of the State the gathering of data needed to make clear what legislative or administrative course will be in the best interest of the State's economic and industrial welfare, and from the standpoint of the Forest Service an enlarged knowledge of Forest conditions and the methods by which our Forests may be made most useful.

BUREAU OF CHEMISTRY.

COLLECTION AND EXAMINATION OF FOODS AND DRUGS UNDER THE LAW.

The inspection and examination of both imported and domestic foods and drugs have been steadily extended along the lines established in the three preceding years, while at the same time the pressure of court work and the necessity for special investigations increase in even greater proportion as the work develops. The total number of samples analyzed at the 21 food and drug inspection laboratories during the past fiscal year was 19,411; of the 9,571 interstate samples about 40 per cent were reported as illegal. This does not indicate at all the condition of the market, as usually only suspected samples are taken and the inspectors naturally become more expert in this respect as their experience widens. It is, however, an index to the effectiveness of the food control. As a result of 87,265 floor inspections, over half of which were made at the port of New York, 8,217 imported foods were analyzed and about 37 per cent were reported as illegal. By this is meant that they were either adulterated or misbranded, and by far the larger number fall in the latter class. In the prosecution of researches in connection with inspection work and in cooperation with other branches of the Government 1,623 miscellaneous samples were analyzed. The desultory examination of

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imported products received at nonlaboratory ports has now been systematized, which will greatly increase the efficiency of this inspection, the leading ports within the jurisdiction of any branch laboratory being definitely assigned thereto. Invoices may now be regularly inspected and examinations made more often than was possible heretofore. In addition to the work of the branch laboratories there should be considered the 2,431 samples examined in the Washington Food Inspection Laboratory, of which 790 were check samples, 994 samples examined in the Washington Drug Inspection Laboratory, of which the greater part were original samples, and about 1,229 interstate samples in the other divisions handling extracts, waters, grains, and cattle foods, a total of approximately 4,654 interstate samples examined at Washington.

SPECIAL FOOD INVESTIGATIONS AND RESEARCHES.

From time to time conditions disclosed by inspection or questions raised in the administration of the law render it necessary to make special studies of certain classes of foods or drugs in order to determine the condition of the output as a whole, fix upon reasonable limits of composition and sanitation within which the products should fall, and if possible assist the producer by the scientific study of the problem under commercial conditions, in meeting the new requirements and improving the material in question. Investigations of this character have been conducted especially in regard to fruit products, dairy products, oysters, and fish. Other researches are of a purely scientific character looking to the development of new or improved processes as in some of the fruit work.

FRUIT AND FRUIT PRODUCTS.

WORMY AND UNSOUND FRUIT.—Many kinds of fruit when sold in bulk and in packages which are not hermetically sealed are subject to the attack of insects unless they are carefully stored, and become wormy and entirely unfit for food. Ripe olives, for example, in bulk, were often found to be of this character. Again, in some countries the practice has prevailed of drying fruits in such a manner that they are attacked by insects before or during the process of drying, so that by the time the product is placed upon the market it is sometimes badly infected by worms or the larvæ and excreta of certain insects. This problem has been carefully studied in various phases. Numerous seizures have been made of dried fruits which were held by the courts as unfit for food because of their wormy condition. A marked improvement has already been made in the grade of figs offered for entry and doubtless it will be still further improved.

MAPLE PRODUCTS.—The prevalent sophistication of maple products has given rise to many cases under the food law, and from the

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necessity of judging of the purity of commercial samples made in different ways and with admixtures of various kinds has resulted a general study of authentic maple products gathered from all of the important centers of production in this country and in Canada. A study of methods of manufacture accompanied the analytical examination of the 481 samples obtained, thus furnishing reliable data for judging of the quality of this product whatever its source might be. Previous work on this subject has covered only limited areas or localities. The results indicate that methods of manufacture influence the variations in color and flavor of the finished product to a greater extent than does the environment.

VINEGAR.—The many cases arising in regard to sophisticated vinegars, especially those in which inferior products are labeled as cider vinegar, has led to a thorough investigation of this industry. Authentic samples were obtained for study at a number of factories throughout the Eastern and Central States, where every stage of the operations could be observed and data established in regard to the progressive composition of the product. In this way such sophistications as the use of vinegar made from apple wastes, dried skins, and cores, or the admixture of pomace and second-pressing vinegars with pure-cider vinegar, or their dilution with grain or white-cider vinegar or with boiled cider may be detected by comparison with the standard data. The results obtained have already been of great value and have made it possible to interpret more intelligently the analytical results obtained in the examination of unknown samples.

MISCELLANEOUS FRUIT PRODUCTS.—A large number of studies were made in cooperation between the Pomologist of the Bureau of Plant Industry and the Bureau of Chemistry looking to the development of new fruit products, the improvement of present processes, and the more profitable utilization of certain crops. Among these are investigations of the yields obtained by different methods of producing grape juice; the effect of storage at low temperatures on sweet ciders, showing that it may be held from six weeks to three months at 32° F. before fermentation begins, that it ferments very slowly and retains its flavor well if withdrawn and held at refrigerator temperature; a successful attempt to produce a marketable vinegar from peaches; the production of a very palatable product by drying and sugaring pineapples; a study of the practice of picking immature oranges and grape fruit and sweating them to produce quick ripening which showed that the product was very inferior and if followed might injure the industry; and a study of the production of citrus by-products in California, together with the examination of authentic samples of Sicilian citrus oils.

Extensive enological investigations were conducted at Charlottesville, Va., with a temporary laboratory in the grape belt of northern

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Ohio, at Sandusky, where 1,077 samples of apples and grapes and their by-products have been examined during this year. Various methods of sophistication were applied and the chemical history of the product studied, as the data are used to assist in administering the food law. A parallel study is made of the composition of products of known history made in the laboratory which provides valuable data on the composition of 62 wines made under controlled conditions from nearly all of the important varieties of grapes used for this purpose in the eastern part of the country. This work is further elaborated by the systematic collection and examination of commercial samples, data on 316 such samples having been accumulated so far. Yeast cultures of different varieties found to have special value are still furnished as starters to laboratories and manufacturers with instruction as to their use, thus aiding in improving the technique of fermentation industries and the quality of the output.

DAIRY PRODUCTS AND POULTRY.

DETERIORATION OF POULTRY AND EGGS.—The study of the deterioration of poultry and eggs, which at first was concerned chiefly with changes occurring during storage, has broadened out so as include every step in the handling of these products. It was soon found that in no other way could the problems involved be attacked, inasmuch as the chemical and bacteriological data obtained could only be intelligently interpreted by a knowledge of the history of the product before entering storage, including methods of killing, dressing, shipping, and marketing. To this end the cooperation of associations of poultry dressers, merchants, railways, refrigeration transportation companies, and warehousemen has been obtained and the most interesting and instructive data have been assembled. The interrelations established explain many variations in data, and in turn the scientific observations set their stamp plainly upon the various methods as producing satisfactory or unsatisfactory products. Extensive shipping experiments were made from Chicago as a center. After visiting the large poultry packing houses throughout the Middle West, observing their methods, and making an accurate record of every detail of manipulation, shipments were sent to Chicago, the carload was met on its arrival, samples were taken for laboratory work, the condition of the car and its contents were examined, including the temperature records, and some of the packages were followed further through the warehouses and the market handling, including in several cases a second shipment by rail.

Specific practical points observed to have a direct bearing on the quality and keeping properties of the product have been studied in the field laboratories located at packing houses—for example, the best way of killing and bleeding fowls and the proper implement to

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use for the purpose, on which circulars have been issued. The variations in drawn and undrawn poultry were experimentally studied on a commercial scale, as were also the comparative merits of scalded and dry-picked fowls. In every case the chemical and bacteriological changes determined are correlated with the history of the shipment and of the conditions of the experiment, and in this way the many factors entering into the problem are controlled. Shipments were made in hot and cold weather and, as far as possible, all the variations occurring in actual practice were duplicated and their effect on the problem weighed. An investigation of the egg industry along exactly the same lines has been inaugurated, data having already been obtained on the changes taking place in eggs of known history and of low commercial grade, during varying periods of storage and at different temperatures, which will serve as the scientific basis for the study of commercial conditions.

DESICCATED EGGS.—Eggs put up in bulk, either frozen or dried, have disclosed in a number of instances the presence of decayed and filthy substance, showing plainly that either purposely or through carelessness spoiled eggs are broken into the cans. A number of notices of judgment have been issued in such cases, and it was deemed wise to make a thorough inspection of egg-packing establishments, observing the procedure from the candling of the eggs to the finishing of the product, and accompanying the inspection with the sampling of the output at various stages for the making of chemical and especially bacteriological examinations. It is obvious that the main consideration is the use of fresh material under sanitary conditions, but it was also developed that some of the details of handling in various packing houses result in lower bacterial counts and a better product than others, and suggestions will be made along these lines.

CONDENSED MILKS.—An extensive investigation of this product, so widely used and relied upon to furnish nutriment for the young, was ordered because of the fact that the manufacturers claimed that the present requirement of 28 per cent of total solids was unreasonable, it being impossible to produce a uniform product of this composition in different parts of the country and at different seasons of the year and have it meet the requirements in other respects. In order to insure justice to the consumer and producer alike establishments of this character have been visited throughout the country, and especially on the Pacific coast, to obtain data in regard to the character of the raw material and methods of manufacture which, together with the chemical examination of the finished products of known history, will provide indisputable data for the settlement of this mooted question. The inspection has been completed and the results are in process of compilation.

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INTERSTATE SHIPMENTS OF MILK.—From time to time the milk supply entering interstate commerce at various large cities is inspected with a view to determining its purity, not only by reason of such adulterations as watering, skimming, etc., but also bacteriological contamination resulting from improper treatment of the cattle, insanitary surroundings, etc.

FISH AND OYSTERS.

CODFISH.—The causes and conditions incident to the spoilage of codfish and other salt fish, particularly during the summer months, were studied, the inspection being accompanied by the necessary microscopical and chemical examinations. It appears that the organisms causing the characteristic reddening of the infected fish occur normally in the localities where the fish are packed and are present in the salt used for curing, exhibiting an unusual toleration for this substance. While the specific organisms causing the spoilage have been determined and some of the conditions favorable to their development established, on which practical suggestions to the trade may be based, the problem must be further studied before the difficulty can be perfectly controlled. The use of pure water for washing the fish, of disinfectants in the packing houses and holds of vessels, and of improved sanitary methods of handling will go far to solve the problem.

OYSTERS.—The danger of contamination of the oyster and clam supply, especially from sewage, but also from conditions under which they are floated, handled, and shipped, was carefully studied. In the prosecution of this investigation many of the largest oyster beds were inspected, location of sewer pipes, etc., observed, methods of handling and shipping studied, and samples of water and oysters taken for bacteriological examination. In many cases conditions of grave danger were observed, which call for the most intelligent and painstaking care to prevent pollution of the supply—the floating of oysters in unclean water, etc. The data obtained have been collated and it is thought that the presentation of the facts, together with sustained inspection, will result in a decided improvement in conditions and point out to the industries concerned the necessity for watchfulness in these particulars.

FOOD CONTAINERS.

Marked progress has been made in the study of the relation of the character of the container to the tin content and keeping properties of canned goods in general. Recent developments in the manufacture of tin plate have been largely in the direction of the preparation of a cheaper product, and one of the efforts of the manufacturers has been to give the plate as light a coat of tin as possible. Since it is manifestly impossible to apply to iron plate a thin coating of tin which is

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entirely impervious, it follows that in the thinner coats the imperfections in the coating are larger and more numerous. Again, the iron plates employed for coating with tin vary in weight according to the size and character of the package. Tin plate of good quality has been found to be suitable for the preservation of the majority of foods, but when the receptacles are made of inferior plate, not only is the tin dissolved in quite large quantities so as to impair the healthfulness of the product, but the coloring matter in many articles of food is unnecessarily destroyed. Some strongly acid foods attack even the better grades of tin, as, for instance, in the case of sardines in mustard, where practically all of the inner coating of the cans may be dissolved in a few weeks. It is highly desirable that a container be found which will be both economical and hygienic, and which will afford inexpensive packages of proper strength yielding no foreign constituents to their contents.

BLEACHED FLOUR.

The trial of two bleached-flour cases during the year was accompanied by the continuation of certain scientific inquiries furnishing data on the effects of bleaching. These have included studies made at the St. Paul and Chicago inspection laboratories with special reference to the grade or quality of flour bleached and the detection of lower grade flours bleached and labeled as Patent, and the comparative effects of bleaching and aging on the physical properties and chemical composition of the product, using patent and clear flours from 15 different localities. Pharmacological studies on the effect of nitrites on smaller animals were also made.

DRUG INSPECTION AND RELATED RESEARCHES.

IMPORTED DRUGS.

The quality of crude drugs, especially those received at the New York port, continues to improve. During the present fiscal year alone the character of certain drug importations has changed markedly for the better, as, for example, in the case of henbane, the importation of the spurious variety having been abandoned, and saffron, no longer containing excessive amounts of styles, or calendula florets colored with coal-tar dye, etc. The inferior materials now received are due principally to careless handling and curing rather than to gross adulteration. The medicinal preparations received, however, continue to be characterized in many cases by mislabeling as to the presence of alcohol, ether, opium, morphine, etc., or extravagant or misleading claims as to their efficacy. An especially reprehensible practice is the importation of cough lozenges, tonic pills, etc., containing opium or morphine. Sometimes these are offered especially for the use of those addicted to the morphine habit, and again as a

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cure for consumption and other diseases. Goods of this nature, put up attractively as a confection and recommended for children's diseases, can be indiscriminately sold and be productive of great harm. Vigorous efforts are made to apprehend such products and prohibit their entry as dangerous to health.

DOMESTIC DRUGS.

The general character of adulteration is the same in the domestic as in the imported drug products. Especial attention has been given, both in connection with the operations of the Post-Office in obtaining fraud orders and by independent work under the food and drug law, to the proper control of the proprietary and patent medicines advertised as cancer, consumption, and epilepsy cures, and the proper labeling of headache remedies, cough sirups, etc., which contain habit-forming drugs and are indiscriminately taken by the general public without knowledge of their dangerous properties. Infant remedies containing morphine or codein are a peculiarly flagrant instance of this abuse, while in other cases the materials offered are harmless but ineffective and are sold for much more than their value, constituting merely a fraud. The work on medicated soft drinks has been continued and of the 15 new brands examined this year all were found to contain caffein and 6 showed small amounts of cocain. The indiscriminate use of the latter drug is one of the most insidious of the threatening evils in this line, its illicit sale even among children having been discovered in some localities.

The educational feature of the work pertaining to the use of remedies or beverages containing habit-forming drugs was felt to be so essential in safeguarding the public health that a popular bulletin was issued on the subject and given a wide distribution, awakening the keenest interest in the press and among physicians, as well as among the general public.

DRUG RESEARCHES.

Research work on the improvement of methods for the determination of synthetic products such as acetanilid, salicylic acid, antipyrin, codein, etc., constitutes an important part of the work, inasmuch as it is necessary to verify accurately the amounts declared on the labels of the many remedies in which they appear as the most important constituent. The origin and sophistication of essential oils, such as peppermint and wintergreen, are subjects of an extensive investigation to determine whether different varieties of plants grown under different conditions yield oils varying from the pharmacopœial standards, and to establish methods for the satisfactory discrimination between the mixtures of substitutes and the genuine articles.

An extensive investigation of the character of the various glacial phosphoric acids on the market was made, the results showing plainly

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that this product consists of variable mixtures of meta-, pyro-, and ortho-phosphoric acids with varying amounts of sodium phosphate. It also appeared that the reversion of the glacial acid occurred not only in commercial brands but in pure meta-phosphoric acid made in the laboratory. Obviously an article of such variable composition should not be used in manufacturing medicines or compounding prescriptions.

MISCELLANEOUS INVESTIGATIONS.

INSECTICIDES AND FUNGICIDES.—The increase of the efficiency of insecticides and fungicides with the control or decrease of the injury done to the plant or tree by their application is constantly the subject of study by the Bureaus of Chemistry, Entomology, and Plant Industry working in cooperation. During the year eight studies of the kind were made, one of the most important being for the purpose of determining the efficiency of sodium cyanid as a substitute for potassium cyanid in fumigating operations, the best proportions to be employed in making the mixture, and the effect of the impurities present in the cyanid on the reaction. The results proved to be of considerable economic value. Lead arsenate has been exhaustively studied, including the examination of 50 commercial samples, directions for preparing this insecticide on the farm, the analyses of the materials entering into its preparation, and observations on the effect of lead arsenates and the impurities present on peach foliage. Orchard tests with numerous poisonous materials are in progress.

TRADE WASTES.—Chemical investigations of the nature and extent of injury to agricultural interests and forests resulting from the fumes, tailings, and other wastes from smelters have been made in cooperation with the Department of Justice, the principal scenes of the operations during the past year having been at Anaconda, Mont., and Ducktown, Tenn. At the latter place plants have recently been erected to condense the sulphur trioxid and dioxid fumes and manufacture sulphuric acid therefrom, thus converting an injurious waste into a profitable by-product. This process has been made the subject of special study. The effect of copper salts on certain grain crops was also investigated to determine the effect of tailings from smelters on farm crops irrigated with water contaminated by such wastes.

CHEMICAL WORK ON PLANT PHYSIOLOGY.—In the majority of studies on plant physiology the effects produced by varying conditions, the periodic changes in composition during the growth of the plant, and the quality of the products yielded by the experiments must be tested by chemical determinations. In collaboration with the offices of the Bureau of Plant Industry, therefore, many such studies are prosecuted, among which the following are of special interest and utility: Acidity studies of peat to determine whether

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the samples are suitable for the growing of blueberries; determination of the nutritive constituents of cereals when grown under different conditions; the determination of changes in composition of a large number of varieties of barley when grown in the same locality for a number of years; the determination of the plant food absorbed by plants grown under different conditions, with a view especially to determining the influence of crop rotation; the composition of cereals, mainly barley and wheat, at different stages of growth, to determine when they can be most advantageously harvested; studies on barley with special reference to its malting qualities; changes in composition of cereals during storage, and the translocation of plant food and the elaboration of plant material during the early stages of the plant's life.

TURPENTINE AND ROSIN INVESTIGATIONS.—The waste in the production of turpentine and rosin is very large, both in the woods and at the still, and the various problems connected with their production, grading, and adulteration have been made the subject of extended inquiry. The errors in vogue in methods of grading rosin have occasioned great loss to the producer, owing to the fact that he can not know what grade of product he has obtained until the factor through whom it is sold reports the same. An accurate but simple and inexpensive method of grading the product at the still has been devised, and its use will, it is believed, enable the turpentine farmer to check the grading of his product and thus materially increase his income. The preparation of permanent rosin types, against which those actually used in grading may be checked from time to time, is being considered, as well as investigations looking to the improvement of the quality of the rosin itself.

THE CHEMICAL CONTROL OF CONTRACT SUPPLIES.—The efficacy of this control of the quality of materials purchased on contract is attested by the increasing demands made from the various Departments for such work, a total of 2,829 samples having been examined, exclusive of 3,600 pieces of apparatus tested for the Bureau of Chemistry. The preparation of specifications for miscellaneous supplies constitutes an important feature of the work, and renders examination of competitive samples in many cases unnecessary when the contracts are let on the bases thus established. The distribution of the work includes colors, paints, varnishes, oils, fats and waxes, soaps, and typewriter ribbons among the largest classes of materials examined.

BUREAU OF SOILS.

SOIL SURVEY.

The Bureau of Soils has vigorously prosecuted the study of the soil resources of the United States during the past year through both field service and laboratories.

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Soil surveys were carried on in fifty-nine different areas in twenty-six different States, and as a result 22,762 square miles were covered in detailed work and 79,108 square miles of reconnoissance surveys, mainly in the Great Plains region. A total area of 359,564 square miles, or 230,120,960 acres, have been surveyed and mapped since active field work was begun in 1899. General interest in the soil survey work has rapidly increased. The interests served by and the agricultural development resulting from these surveys are very large, though not readily expressed in figures.

The Survey has cooperated during the year with state organizations in New York, Pennsylvania, New Jersey, West Virginia, North Carolina, Alabama, Mississippi, Missouri, Wisconsin, and Washington. State funds have been used to facilitate and expedite the soil survey work in localities of especial interest to the local state authorities.

With the final occupation of the arable lands of the country, which has been practically accomplished, and coincident with the rapidly increasing population, it is clear that the pioneer methods of agriculture are inadequate for the increasing needs of our people. The time has come when a more intensive and more stable system of agriculture must prevail. The basis for this change is the intelligent use and control of our soil resources.

In the Eastern States adjacent to the larger markets the situation is due to a too widespread adhesion to methods of the past. The soils of the Eastern States, however, are fundamentally sound and are as well suited now to intensive and intelligent culture as they were originally to pioneer and extensive use. There is abundant evidence that with a thorough knowledge of the soils and the intelligent application of modern intensive methods the yields per acre of our staple crops can be increased many times. The soil surveys in New York and the New England States, in Pennsylvania, Maryland, and Virginia, representing the longest occupied soils of the country, justify the confident assertion that these older soils await merely more intensive methods in order to respond more bountifully than ever before. The soil survey is the foundation for future work, outlining the different types of soils and describing their peculiarities and their requirements, while laboratory investigations are showing the many interdependent functions of soils and how they are susceptible of control by human agencies.

The soil surveys are showing the vast opportunities of specialization in the large number of soils of the Atlantic and Gulf Coastal States. They are showing similar opportunities for specialization in truck, fruit, and general farm crops on the many types of soils in the Glacial Lake region of the North. They are showing the soil opportunities in our limestone valleys and the great Central West for the production of our great grain, forage, and fruit crops for the fall

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and winter markets. In the region of the Great Plains the different soils are being outlined which have a direct and dominant value in the distribution of crops under dry-land farming. In the western valleys and the reclamation projects the soils and alkali conditions are being mapped as a guide to the use and treatment of the soils under irrigation. On the Pacific coast the surveys are mapping the soils adapted to the important interests of that section, including the production of general farm crops and the highly specialized fruit and truck interests.

The Great Lakes region possesses some of the most valuable agricultural land in the United States, and upon the best of its soils the highest types of mixed dairy and general farming are developed. The northern part of the region, however, contains many thousand acres of light sandy soil which has heretofore yielded but little of either natural forest products or subsequent farm crops. Experiments of a practical nature and on a regular farm basis, both by scientific experiments and pioneer farmers, are, however, demonstrating the fact that even the loose, sandy jack-pine lands can be profitably cultivated when just the proper methods are employed. The proper crop adaptations of these glacial soils of widely different characteristics and capabilities are being studied by the Bureau. The information gained from both detailed and reconnoissance soil surveys aids greatly in the intelligent selection and uses of the soils in a sparsely settled region of cheap lands as well as in the more intensively cultivated areas where comfortable livings can be made from smaller farms of higher price and greater productive capacity.

The ravages of the cotton boll weevil in the Gulf States has created an intense interest in the diversification of crops on the one hand and the specialization of crops and agricultural interests on the other. Consequently that section of the country has been especially urgent for increased knowledge of its soils as a safe and fundamental guide in its development.

The reconnoissance survey of the Great Plains region, begun in 1908, was continued by the survey of three additional areas; one in the central Gulf coast of Texas, another in the panhandle of the same State, and the third included the entire western half of Kansas.

These reconnoissance surveys show the general character and distribution of the different kinds of soils in the area covered, their relative agricultural possibilities, and the crops which have been and will prove most successful. They furnish a large amount of valuable and accurate information, not only to prospective settlers but also to those farmers who are already in the areas. The rapid development of these sections created an immense demand for these reports and some of those already published were exhausted within four months of their issue. This work will continue during the winter with the

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survey of another area in south Texas, to be followed next summer by one in western Nebraska.

The reconnoissance work on the soils of the Ozark region of Missouri and Arkansas, begun in 1909, was completed in 1910. The area covers a large part of the territory of both States lying between the Missouri and Arkansas rivers, amounting to about 58,000 square miles. The agriculture of the region is just now at a turning point in its development. The continued use of the soils, as though in the pioneer stage, is no longer possible on account of a number of changes, both natural and artificial. The farmers are seeking to adjust themselves to the new conditions, but with only moderate success in a few localities. The study of the soils of the region at this time is most urgently needed.

In cooperation with the Washington geological survey an extensive area of logged-off and burned-over lands in the vicinity of Puget Sound has been surveyed. The results will provide a basis for active state aid in clearing and developing these unproductive lands, including reforestation of such tracts as are unsuited to ordinary farm crops.

In cooperation with the Pennsylvania State College of Agriculture a reconnoissance survey has been made of the high plateau of the western half of the State. This great work will be completed in that State within a year or two and will be followed as rapidly as possible by detailed surveys of the more important centers of agricultural occupation.

SOIL-WATER INVESTIGATIONS.

Soil-water investigations naturally fall into two major lines—that of the surface waters which are likely to erode the soil and injure the field by rendering the surface rough and uncultivable and carry off the most productive portion, and that of the subsurface waters which move through the soil, resembling a great arterial flow in carrying material from place to place and performing an important function in maintaining stable conditions for crops and the permanency of the soil itself. Especial attention has been given to this latter line of work during the past year.

The soil-water investigations both on the Great Plains and in valleys among the mountains show the great extent and agricultural importance of the ground waters. In the Great Plains these waters, derived partly from local rainfall, but largely from the heavier precipitation in the mountains, permeate the formations and deposits, pass through them at widely varying rates, and approach the surface under their particular hydrostatic head, often within reach of the ordinary capillary movements. When thus brought near the surface the waters improve the constitution and increase the productivity of the soil. Even at greater depths they are generally within reach of

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wells; and they supply the springs and seep-fed streams required for the use of stock. These waters, often neglected, materially increase the productivity and habitability of the Great Plains and of many valleys in the mountain region, and more especially where they are conserved for crop growth through dust mulching.

LABORATORY INVESTIGATIONS.

The progress of the laboratory investigations has emphasized that a soil has so many properties, physical, chemical, and biological, each of importance in the production of crops, that it is essentially an individual, and that no two soils are or can be made just exactly alike. Everything in a soil is involved in continual changes, and these changes are of as much importance to plant growth as are the things themselves. Cultural methods never affect one only, but always every factor involved in crop production. For instance, an addition to the store of plant food in the soil sometimes produces undesirable physical or biological conditions, with decrease in crop results. The interrelations between the soil factors influencing crop production and an intelligent control by cultural methods is perhaps the most important problem with which scientists are now engaged, and whose solution is a primary object of the Bureau's work. Among the results of the past year's work and of more general interest the following may be cited:

Relatively small quantities of mineral fertilizers produce profound physical changes in the soil water, affecting its movements. The addition of such substances to a soil affects in definite ways that content of water which is the optimum for plant growth, an important factor, since the soil solution and its accessibility to the growing plant are dominant factors in determining the kind and amount of plant growth. All the physical properties dependent upon the relation of the soil to its water content affect plant growth and are affected by any one of the general methods of soil control, namely, tillage, crop rotation, or fertilizers. The relation of physical properties to the moisture content of a soil is being studied vigorously.

Soils are far more heterogeneous than the rocks; in fact, all kinds of rock-forming minerals are found in nearly every soil and among the soil particles of all sizes. Certain characteristics of particular minerals show the nature of the geological processes involved in the formation of the soil which affect their adaptation to crops. All the mineral-forming elements may be expected in practically every soil; this has been shown for barium, as well as the usual plant foods. Furthermore, even very old soils, long under cultivation, are essentially the same in mineral characteristics as new and virgin soils. Chinese soils, which are authoritatively reported to have been under clean cultivation for upward of three thousand years, contain all the common

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rock-forming minerals, and have an even higher content of the essential mineral plant nutrients than well-known and highly productive soils in the United States.

Important results have been obtained in certain lines of work pursued in connection with soil-fertility investigations. The new point of view which has been brought to bear on the problems connected with the fertility of soils has opened up avenues of profitable investigation and already forecasted results of great economic importance.

Whatever adds to the biochemical knowledge of soils advances and broadens our understanding of the complex problems of soil fertility. Important facts have been ascertained in regard to the functional activities of soils, such as oxidation, reduction, etc., and their bearing upon soil fertility determined. The isolation in a pure condition of some of the organic constituents of soils has made possible the correct interpretation of soil changes and the discovery of compounds in the soil harmful to crops. This line of research has been especially profitable this year and has led to the separation of more than twenty definite compounds. Previous to this investigation not a single organic constituent of the soil was known, and the results thus far obtained are very gratifying. There has been studied the effect of these compounds, and of the soils containing them, on plant growth and the ameliorating effect of certain treatments of the soil and the addition of fertilizers. It has been found that fertilizers aid very materially in counteracting the effects of such soil constituents and that certain treatments destroy or remove them entirely.

THE USE OF SOILS.

In the twelve years which have elapsed since the initiation of the soil survey the Bureau has accumulated a vast amount of material concerning the soil resources of the United States. Much of this material is scattered through the annual volumes of the Field Operations, but much is in other publications and unpublished records.

It has been found during the past year that the time has come when it is possible to prepare a comprehensive statement of our soil resources, showing the origin, extent, distribution of, and the uses to which each individual soil type is being placed and can best be placed. A series of reports or monographs is under preparation upon the characteristic soils of each of the soil provinces into which the country is naturally divided. These monographs will constitute an inventory of all of the more important facts concerning the soils of the entire country, the production that is now obtained from them, and the possibilities which they hold for the Nation's future. They will furnish a basis for the future development of the agriculture of the American people of a character and breadth of scope never before available to any Nation.

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BUREAU OF ENTOMOLOGY.

The work of the Bureau of Entomology as a whole is divided into sections or main projects, which include work on the gipsy moth and the brown-tail moth, importations of useful insects, exportations of useful insects, investigations of insects damaging southern field crops, of insects damaging forests, of those injuring deciduous fruit trees, of those which prey upon cereal crops and forage plants, of those which injure vegetable crops, of those affecting citrus fruits, and of those which destroy stored foods, as well as investigations of insects in their direct relation to the health of man and domestic animals, and the study of bee culture in a broad way. Such inspection as can be done under existing laws comprises another aspect of the Bureau's efforts. Only a few of these projects will be touched upon here.

WORK ON THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

The largest problem, from the point of view of financial expenditure, which comes under the work of this Bureau, is the effort to restrict the spread of these two insects, which have been doing an enormous amount of damage to the trees of certain New England States and which threaten to extend their range to other portions of the country. The States involved are Massachusetts, New Hampshire, Maine, Rhode Island, and Connecticut. Realizing from the start the practical impossibility of establishing a quarantine line around the limits of distribution and working back toward a common center, it was decided that, since the gipsy moth spreads principally in the caterpillar stage (the female moth being unable to fly), and largely by dropping from roadside trees upon passing individuals and vehicles, the best results could be accomplished in an effort to prevent this sort of spread by cleaning up the roadsides in the most thickly infested and most traveled sections. It was decided that the brown-tail moth, having extended powers of flight, could not be controlled by any such method, but that, owing to the prevailing direction of the winds at the season of flight, its spread to the west and south would always be comparatively slow. Therefore the efforts with this species have been to urge upon the States concerned the enforcement of state laws already in existence and to take part in the general campaign of the education of people in regard to the habits of the insect, and to encourage in every way the destruction of the winter nests, since, during the season when the leaves are off the trees, these nests are readily observable and can be picked off and destroyed. As the result of the work carried on down to the present time, the living conditions in the infested area have been vastly improved and the spread of the gipsy moth has been greatly retarded. Street and roadside trees have, as a rule, retained their full foliage, and no great loss of verdure is now noticeable except in forested areas.

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This is in vivid contrast to the conditions which existed at the beginning of the work. Even in forested areas there has been no extensive death of trees owing to complete defoliation. The reason for this is that the destruction of the leaves of a given area for two consecutive years seldom or never happens. When a woodland colony of the gipsy moth increases to such a size as to bring about the complete defoliation of an area, the numbers of the caterpillars are so great as to cause their death by millions from overcrowding, disease, starvation, and the attacks of natural enemies. It results that practically only those individuals on the border of the area survive and propagate, so that the following season not the old area but a contiguous area receives the attention of their offspring.

Aside from the clearing up of roadsides, extensive search during the winter season is carried on all around the borders of the area known to be infested, in order to discover at the earliest possible date either new colonies or those which have existed for some years but which have not before been found. Egg masses, where found, are destroyed. In the early summer, after eggs have hatched, extensive spraying operations with arsenical mixtures are carried on. Many trees are banded with a sticky mixture to prevent the ascent of caterpillars. By arrangements with the railroad companies, all shipments of lumber and all articles likely to carry the eggs of the gipsy moth from within the infested territory to other parts of the country are inspected before shipment, in order to make it certain that the insect will not be spread by this mode of distribution.

In all of the States mentioned the Department works in hearty cooperation with the state authorities. Each of the States is assisting—Massachusetts, Maine, Connecticut, and Rhode Island effectively; New Hampshire not so effectively.

During the past fiscal year it has transpired that the infested area is somewhat larger, but the rate of increase has been shown to be proportionately less than it has been any year since the beginning of the work. The infested area in New England is now a little more than 10,500 square miles. The work in Massachusetts is carried on along the old lines. In New Hampshire about 100 men were kept in the State during the winter carrying on scouting operations and applying creosote to the egg clusters along the roadsides. This scouting indicated the presence of the gipsy moth in twenty-one towns where it had not theretofore been suspected. There were no large colonies, and in some of the towns only single egg clusters were found. There seems to be little hope of controlling the gipsy moth in New Hampshire until the authorities appreciate more fully the serious character of the threatened damage. A local organization should be brought about in each city and town, under state supervision, and a constant concerted effort should be begun. There is the

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same necessity for concerted work in this State against the brown-tail moth. Conditions in Maine as compared with New Hampshire are much better. Some large new colonies were located by scouting, but some of the older ones seem to have been extirpated. The brown-tail moth seems possibly to have reached the northern limit at which it can thrive in Maine. The condition in Rhode Island is very favorable, and the gipsy moth is less abundant in that State than at any time since its control was undertaken. In Connecticut the colony near Stonington is nearly exterminated; less than 100 caterpillars were found there during the summer of 1909, while in the following winter but a single egg cluster could be found by the combined efforts of the state people and the Government people. This very promising condition at Stonington, which heretofore has been the only infested town in the State, was offset by the discovery in December, 1909, of a bad colony in the town of Wallingford, near New Haven, which has probably existed there for three or four years undiscovered. The colony, however, seems to be definitely limited, and strong efforts are being made to exterminate it.

Slow but steady improvements in methods have been made and practical new points in the economy of the gipsy moth have been discovered. The hitherto only known method of spread has not explained perfectly the presence of this insect in entirely isolated woodland colonies, and this year a careful series of experiments has shown that the newly hatched caterpillars may be distributed by the wind—in fact, it has been definitely proved that they have been carried in this way for more than 1,800 feet. This discovery will probably necessitate some modification in methods.

All of this work has necessarily been on a large scale, and the Department is experiencing considerable difficulty in securing first-class men. At times 500 men have been employed. Forty tons of arsenate of lead were used during the spraying season, and 20 tons of the sticky substance used for tree banding. The outlook, on the whole, is far from unfavorable, and surely the work carried on by the Bureau has been done in the most intelligent and efficient way.

THE IMPORTED PARASITES OF THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

The work mentioned in the preceding paragraphs can not be expected to bring about the extermination of the two tree pests. This is made plain even in the wording of the appropriation act, by which Congress instructs that the money is to be spent in an effort to prevent the spread of the gipsy and brown-tail moths. It is hoped, however, that it will minimize the damage and prevent undue spread until such a time as the parasites which have been and are being introduced from abroad shall have reduced the dangerous insects to a condition of comparative harmlessness. These efforts

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to introduce and acclimatize parasites which attack the injurious moths in their native homes have been carried on now for rather more than five years. The work has been novel in its character and entirely unprecedented in its scale, but it was initiated under more favorable conditions than could have occurred elsewhere in the world, on account of the intimate acquaintance possessed by members of the Bureau force with parasitic insects and their habits.

The progress made from year to year has been shown in my annual reports. It was at first hoped and even expected that appreciable results in the obvious lessening of the damage done would be perceived in a very few years—say three or more—but with a better understanding of European and Japanese conditions and with a closer knowledge of the biology and interrelations of these very minute creatures, complications have arisen which, while affording new and important light, have lengthened the estimate of the Bureau of the time needed to get the best results.

During the past fiscal year a larger amount of parasitized material was imported than ever before, and the thanks of the Department are due to officials in Italy, France, Spain, Portugal, Russia, and Japan for assistance in this work. Some very notable examples of progress have been observed. The European predatory beetle known as *Calosoma sycophanta* now exists in great numbers over a large area. It was so abundant in some localities the past year as to affect the gipsy moth materially. A parasitic fly of the genus Compsilura, first liberated in 1906, during the present season has been shown to have increased fiftyfold annually and to have spread 10 or 12 miles in every direction each year. It has destroyed large numbers of gipsy moths and an appreciable percentage of the brown-tail caterpillars, and is now turning its attention to certain native species, such as the fall webworm and the tussock moth, which, through their autumn feeding, afford food for a generation of the parasites at a time when the gipsy moth and the brown-tail moth are not available. Still another species has been found to attack the caterpillars of the cabbage butterfly as well as the two species for which it was imported. The European Monodontomerus, which was found last year to have spread over an area of approximately 500 square miles, has continued to increase and to disperse rapidly. It has crossed into New Hampshire, extending its range 10 miles in every direction, and must be at least twenty-five times as numerous this year as last. A parasite of the eggs of the gipsy moth (Anastatus) survived the winter of 1909–10 and appears to be strongly established. This parasite will be of very considerable assistance, although alone it could not be a very serious check to the gipsy moth, since its larvæ destroy only the topmost eggs in a gipsy-moth egg mass and since it wastes many of its eggs. The condition of the parasite work, on the whole, is distinctly more encouraging than it has hitherto appeared to be.

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WORK IN THE ORANGE AND LEMON GROVES OF CALIFORNIA AND FLORIDA.

One important investigation of the Bureau was completed with the close of the last fiscal year, namely, the study of the problem of hydrocyanic-acid gas fumigation in California directed against certain scale insects on citrus trees. The problem was attacked from all points of view, with the prime idea of increasing the efficiency of the process, which had previously been carried on in a wasteful and unscientific way, and of reducing its cost. It has been shown as a result that the extremely satisfactory increase in the efficiency of the process, brought about by the careful experimental work carried on, has in itself greatly reduced the cost, since one treatment under present methods is as lasting in its effects as three or four distinct treatments under old methods. A practical man in southern California, himself a large gainer through the results of this investigation, and who closely watched the Bureau's experts at their work, informs the Department that at least $250,000 has been saved to his region.

The work on the white fly in Florida has been carried on, and the principal efforts of the year have been with insecticides and spraying methods as adapted to Florida conditions. It has been found that by careful application of knowledge gained by studies of the life history of the white fly the cost can be reduced to two-thirds during late spring, while other experiments have shown that the cost can safely be reduced about one-half during the summer months on account of the greater susceptibility of the insect in the conditions in which it is to be found at that season. All efforts to adapt native parasites of allied insects to the citrus white fly having failed, and Congress having authorized a search for the foreign parasites of this destructive species, an expert agent has been sent abroad upon this important search and at latest advices was in India, which has been supposed by naturalists to be the original home of the white fly.

In my last annual report I called attention to a new insect enemy of the orange, in the shape of a thrips, which punctures the rind of the fruit, making it scabby and reducing its value. The same insect also injures the young leaves. An investigation of this insect has been carried out through the year, and large-scale experiments have been made with various sprays, some of which have been found to be successful. Unfortunately there is a series of generations of the insect throughout the year, which renders two or three spray applications necessary. The Bureau has especially introduced spraying methods, and a large number of power sprayers have been purchased and extensive operations begun under the advice and immediate

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supervision of the agents of the Bureau. In less than a year the problem was practically solved and the means of protecting the crop was demonstrated.

WORK AGAINST FOREST INSECTS.

Previous investigations in work against forest insects have resulted in a thorough knowledge of the life histories and methods of work of the principal forest insects, and have indicated not only that the forest-insect problem is to be classed among the more important problems in connection with the waste of forest resources, but also that this waste can be controlled with economy and success. The Bureau, after obtaining the necessary preliminary results, is now in position to demonstrate upon as large a scale as this can be brought about the efficacy of the measures decided upon. It has been shown that the methods recommended may be easily understood and properly applied by owners of timber, by Government forest officials, and by managers of manufacturing enterprises through the proper expenditure of a comparatively small amount of money and energy. This has been shown in the areas in Colorado in the vicinity of Colorado Springs, Palmer Lake, and Idaho Springs, on the Trinchera estate, in the Las Animas National Forest, in the Wet Mountains section of the San Isabel National Forest, Colorado, and in the Jefferson National Forest, Montana. The evidence gathered from the results of the investigations and control work relating to these seven cases indicates that the proper disposal of a total of some 14,000 trees during a period of four years at a first cost of about $2,000 (an average of 50 cents per tree) has ended depredations which during a preceding period of ten years have caused an average annual death rate of more than 7,000 trees, or a total of 7,000,000 feet board measure, having a stumpage value of $14,000.

The work carried on in cooperation with private timber owners and forest officials in northwestern Montana, inaugurated last autumn, has yielded most satisfactory results, especially in the fact that the private owners have been made to realize the importance of prompt action to prevent the total destruction of the remaining merchantable timber. This has led to the proper treatment, by cutting and barking or otherwise disposing of between 9,000 and 10,000 beetle-infested trees, by ten or more of the owners. This, it is believed, will be sufficient to control the depredations over an area of more than a hundred square miles in which the timber has been dying at an alarming rate during the past ten or fifteen years. It will also have a marked effect toward protecting the timber of the adjacent areas of the National Forests, in which similar destruction has been going on. The Department of the Interior has allotted sufficient funds to take immediate

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action in the southern section of the new Glacier National Park, and the Forest Service will take up the work within the Flathead and Blackfeet National Forests during the coming year. This work, in addition to the work of private owners, should effectually check the insects throughout the whole area, and thus end the losses of timber which have been progressing in this general region during the past ten years at a death rate of at least 200,000 trees annually.

During the close of the year there has been organized the most extensive cooperative project for the control of bark-beetle injury that has ever been undertaken in this country. This is in northeastern Oregon and western Idaho, and involves an area of over 13,000 square miles. It is undertaken through cooperation between the Bureau of Entomology, the Forest Service, and private owners, and provides that the experts of the Bureau of Entomology shall make investigations of the insects, recommend methods of procedure, and give special instructions and advice and essential details, while the Forest Service and the timber owners provide the funds necessary for actual control operations. It is expected that this work will prevent the further loss of timber which has been going on during the past five or six years at an estimated value of nearly a million trees per year.

INSPECTION WORK.

In my last report attention was called to the widespread introduction of the winter nests of the brown-tail moth upon apple and pear seedlings coming to the United States from portions of France, and an account was given of the methods adopted to secure the inspection of all imported material of this class at the point of ultimate destination. During the autumn and winter of 1909 similar injurious introductions constantly occurred. Very many nests of the brown-tail moth were brought in in this way, and an egg cluster of the gipsy moth was found upon stock sent from Belgium to Louisiana. By an especial arrangement with the Secretary of the Treasury, with the custom-houses, and with the railroads, the Bureau of Entomology was notified of all cases of plants received, and, as in the previous autumn and winter, the inspection of probably every shipment was secured at the point of ultimate destination. Shipments of nursery stock to the number of 291 were found infested with nests of the brown-tail moth, and these went to Colorado, Connecticut, Georgia, Illinois, Indiana, Kansas, Louisiana, Michigan, Montana, New Jersey, New York, Ohio, and Virginia. In most of these States inspection was rendered simple by the fact that there were efficient state inspection laws and efficient inspectors. Notification in such cases from the Bureau was all that was necessary. In other cases, where there was no such state service, the inspection was carried on either by

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employees of the Bureau or by expert collaborators appointed for the purpose.

In addition all seeds and plants introduced and distributed by the Division of Foreign Seed and Plant Introduction of the Bureau of Plant Industry, as well as all ornamental plants imported by florists in the District of Columbia, have been thoroughly examined. Moreover, about 2,000 cherry trees, a gift from the city of Tokyo to the Government of the United States, were examined and found to be infested with a number of injurious insects, necessitating, most unfortunately, the destruction of all these plants.

The United States is practically the only one of the great nations of the world which is not protected by law from such accidentally caused importations of pests of this character. During the last session of Congress an inspection law, based upon the permit system, was drafted and submitted to Congress after consultation with the legislative committee of the National Nurserymen's Association. Thorough hearings on the bill were held before the Committee on Agriculture of the House, but, owing to pressure of other matters which seemed of more immediate weight during the closing portion of the session, the act was not placed on the calendar. The need, however, of a national quarantine and inspection law of this general form is a crying one, and the country is in constant danger of the importation and establishment of new pests of a serious character just as long as it does not protect itself in this way.

The extensive accidental importations of the brown-tail moth during the past two years have been due to somewhat unusual conditions in the nursery-growing regions in France, which have bettered much during the past season. During the growing season of 1910 in the nursery regions of France both the gipsy moth and the brown-tail moth were almost entirely absent, so that the danger of importation during the coming autumn and winter is undoubtedly less than during the two previous seasons. Both the Belgian and French Governments, largely owing to representations from this Department, have adopted regulations providing for the inspection of nursery stock exported to this country, and such action is expected on the part of England, Holland already having a competent service. These actions on the part of these Governments will alleviate conditions, but will by no means remove the necessity for a protective law in the United States.

OTHER WORK.

Among the other important affairs of the Bureau during the past fiscal year the following should be mentioned:

The continued work on the cotton boll weevil and other cotton insects in the South has shown good results in the utilization of native parasites and in the study of the adaptation of the insects to the

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new conditions met with in its continued spread to the north and to the east. The work upon tobacco insects has progressed, and that upon sugar cane and rice insects has made a good start. The work upon the pear thrips in California, practically completed from the investigational side during the previous fiscal year, has been carried on by the conduct of large demonstrations which have indicated in a very perfect way the practical value of the conclusions previously reached. Studies and demonstrations with the codling moth have been continued. The work upon the grape root-worm has been completed, and an interesting investigation has been followed in the study of arsenic accumulations in the soils in sprayed woodlands, orchards, and vineyards. Demonstration spraying has been carried on against the plum curculio, and the investigation of cranberry insects is nearly completed. Further studies on the green bug, the joint-worms, and the Hessian fly have been carried on, and studies of two new pests, namely, the New Mexico range caterpillar and the alfalfa weevil in the West, have been begun. The work against truck-crop insects in Tidewater Virginia, in North Carolina, Colorado, Mississippi, California, and southern Texas have resulted in results of value to the growers of those regions. Studies of the house fly have been continued. The work on the Texas cattle tick has been forwarded, and a thorough investigation of the tick which carries the spotted fever of human beings in the Rocky Mountain regions has been begun. The investigations of stored-product insects have comprised a careful consideration of the point of infestation of export flour and experimental work in rice mills of the South. The work in bee culture has been devoted largely to the study of bee diseases, but other investigations in this direction are under way.

BUREAU OF BIOLOGICAL SURVEY.

The Bureau of Biological Survey has continued its investigations of the economic relations of our wild birds and mammals with special effort to render its work of practical importance to the farmer and stock grower. It is gratifying to note that as the work of the Bureau becomes more widely known it meets with increasing approval and support from those it is intended to benefit. A remarkable and, until recently, quite unexpected broadening of the work of the Survey into the field of the preservation of the public health has resulted through the fact that some of our native wild mammals have been proved to be disseminators of such fatal diseases as the bubonic plague and the spotted fever.

RATS AND THE BUBONIC PLAGUE.

So important is the rat in its relation to the public health that its extermination has become one of the serious problems of modern times, both in the United States and in foreign countries. Since it

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has been established that plague is primarily a rat disease and that it is transmitted to human beings chiefly by the agency of the fleas which infest rats, this aspect of the problem has quite overshadowed the purely economic side of the matter, important as that is. During the year experiments with traps and poisons were conducted, these being the chief present available means for reducing the number of noxious rodents. So great are the rat's productive powers, however, that unless these measures are persistently and energetically pushed the relief obtained is only temporary. It can not be too strongly emphasized, therefore, that permanent freedom from the pest can be secured only by preventive measures. When a building is infested by rats, it can be freed from the vermin by stopping means of ingress, usually not difficult nor expensive, and then depriving the animals of food, when they can be easily trapped. What is true of single buildings is true of cities and communities. When the public is educated to the importance of withholding all food supplies from rats, and when buildings are made practically rat proof, a very long step will have been taken toward the solution of the rat problem.

Inasmuch as requests from various parts of the country as to the effectiveness of bacterial preparations for destroying rats continue to be received, the results of experiments of the Survey with several such preparations now on the market may be repeated. When fresh and virulent, the preparations can usually be depended on to kill the individual rats eating the prepared baits, but they do not set up, as has often been claimed, an epidemic among the rodents. They are hence regarded as inferior to poisons because of their uncertainty of action, ineffectiveness, and cost. The cost indeed is practically prohibitive when the preparations are required to be used on a large scale.

CALIFORNIA GROUND SQUIRREL.

The California ground squirrel continues to be the subject of important field investigations because it annually destroys millions of dollars worth of grain, fruit, and nuts, and because it tunnels in irrigation embankments. Thus in May, 1910, ground squirrels caused such a serious break in the Turlock Canal in Stanislaus County that the cost of the necessary repairs amounted to $25,000. As the repair work occupied some three months, the ranchers were deprived of water at the very season when most needed, the resulting loss of crops being estimated at upward of a half million dollars. Still more important is the fact that this squirrel has become plague-stricken. Already three or four persons are known to have been infected with plague from squirrels. The real significance of the spread of plague, however, to this wild mammal is not so much the present danger of infection of a greater or less number of persons, but the fact that unless vigorous steps are taken the disease is likely to become per-

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manently endemic in California, as it is in India among certain of the native rodents. Should plague become firmly established among ground squirrels or other of our rodents, there is danger that the disease in a virulent form may be communicated from them to human beings at any time; there is the added danger that as the distribution of squirrels over a large part of California and other Western States is practically continuous, the disease is likely to spread from colony to colony, to other parts of the State, and even to other States. Thus the plague epidemic in California, which at first sight might appear to be of purely local concern, assumes national importance and the destruction of ground squirrels becomes imperative. It is hence very important to exterminate the animals in the sections immediately contiguous to San Francisco, and by due care and vigilance to prevent their reentry into the freed territory. A neutral belt thus being established around San Francisco, and if necessary other seaports, and the agency of ground squirrels in the spread of plague being eliminated, should the disease at any future time enter San Francisco or any other of our west coast ports it can be restricted to very narrow limits, when its eradication will be comparatively easy.

With a view to a war against ground squirrels, investigations have been made during the year for the purpose of ascertaining the cheapest and most effective methods of killing them. Numerous experiments have been made with poisons and with baits for use in different localities and at different times of the year, and excellent results have been obtained.

After many experiments covering the dry season, whole barley has been found to be the best vehicle for carrying the strychnine, which, all things considered, has proved to be the most effective poison. The barley is coated with a starch solution holding strychnine in suspension. It has been demonstrated that by a single treatment the ground squirrels have been practically exterminated over large areas of wheat land at a cost less than one-half that of the methods that have hitherto been employed. Thus, during the past season careful tests of the starch-barley preparation over 50,000 acres in several localities in the State proved that ground squirrels can be practically exterminated over large areas at a cost of from 2½ to 6 cents per acre, depending on the abundance of the squirrels and other local conditions. The method has been tested widely enough to prove that during the dry season, from April till October 15, it can be successfully used in all parts of the State, and it works equally well on the three species of ground squirrels found there. The starch-barley preparation has the added advantage that it destroys practically no wild birds and may be safely employed in pastures, on sheep ranges, and along public highways.

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Attention has been given also to the habits of the California ground squirrels, especially during the breeding season, since it is evident that the most effective way of reducing their numbers is to kill them prior to the time they have young, especially as they are very prolific and have from four to eleven at a birth.

RODENTS IN RELATION TO REFORESTATION.

One of the most important of modern forestry problems is the economical reforestation of treeless areas within our National Forests. When attempts at reforestation were made on a large scale by the Forest Service, it was found that, after seeding, on an average about half the seed planted was dug up and eaten or carried away by mice and chipmunks, thus adding largely to the cost of the undertaking. In some localities as high as 70 per cent of the seed has thus been lost, which loss is prohibitive of the work. As these rodents are exceedingly numerous within all forest areas and clearings, attempts at seeding without protecting the seed in some way or largely reducing the number of rodents proved practically hopeless. Accordingly, at the request of the Forest Service, experiments were begun by the Biological Survey for the purpose of finding a remedy. Many experiments were made to protect the seed with a coating of such substances as red lead, copper sulphate, and coal tar, but they failed. Attempts to poison the animals, however, have proved very successful. Oatmeal mixed with strychnine and water, or wheat coated with hot tallow mixed with strychnine as a protection against rain or moisture, proved very effective. The poison is distributed over the tract to be planted several days in advance of seeding operations, when the subsequent loss by rodents is inconsiderable. It is believed that the adoption of this plan will solve one of the chief difficulties connected with reforestation.

RODENTS AND SPOTTED FEVER.

It is believed that the dreaded spotted fever, which prevails in certain sections of the Rocky Mountain region, is transmitted to human beings by ticks which harbor on certain of our native mammals. As having an important bearing on the attempts to eradicate the disease, it is extremely important to ascertain the species of mammals concerned in its transmission. Hence the Survey was asked to cooperate with the Bureau of Entomology and the officials of the State of Montana in an investigation. Accordingly, two assistants of the Survey spent several months in Bitterroot Valley, Montana, trapping mammals, especially the smaller rodents, and studying their habits with a view to the discovery of the species that harbors ticks. So far fever ticks have been found on twelve species of wild

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mammals in and near the valley. It does not follow, however, that all ticks found on mammals are capable of transmitting the fever. The ticks discovered and all mammals showing symptoms of disease were given to experts for examination. The results of the work of the past season should go far to aid in a solution of this important problem. Should it prove, as seems probable, that the Columbia ground squirrel or some other rodent is responsible for the spread of the disease through the agency of ticks, it is believed that a practicable plan can be devised for reducing the numbers of the animals within the confines of Bitterroot Valley and other inhabited localities in the Rocky Mountain region where the fever is prevalent, so that in future it need be little feared.

PRAIRIE DOGS.

In certain regions of the Middle West prairie dogs exist in great numbers, and so numerous are their colonies in certain places that they seem to form one continuous settlement. In such areas, where the little rodents number many thousands, the damage they do to forage grasses and other vegetation is very great. The extent of this damage can be realized when it is known that 35 prairie dogs during their season of activity eat as much grass as one sheep and 210 eat as much as a range steer. In the days of unlimited public pasturage such losses passed almost unnoticed, but the increasing value of grass lands for stock ranges makes it impossible to ignore them longer. In thickly settled farming communities the extermination of prairie dogs is comparatively easy, since it is possible to secure the necessary cooperation between landowners; but in sparsely settled areas and on large stock ranges cooperation is difficult or impossible to obtain, and the cost of extermination bears heavily on individual owners. To discover methods of destruction of the utmost efficiency and at a minimum of cost has been the endeavor of the Survey, and investigations to this end have been made during the past year in New Mexico, Colorado, Wyoming, and Montana, and are still in progress. Oats poisoned with strychnine have proved to be the most attractive bait so far experimented with, but as the use of this grain endangers the lives of valuable birds like shore larks and longspurs, further experiments will be made with a view to obviating this disadvantage.

BIRDS IN RELATION TO THE CODLING MOTH.

The codling moth occurs in every apple-growing region of the United States, and where no effort is made to check its ravages it destroys from a fourth to three-fourths of the crop. It has been estimated by assistants of the Bureau of Entomology that the annual loss in the United States due to the codling moth, including

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the cost of efforts to control its ravages, is 15 million dollars. In connection with an investigation of the bird enemies of this pest, preliminary work was done by an assistant of the Survey in the Blue Ridge apple region of Virginia. Twenty-five species of native birds are known to prey upon this exceedingly destructive insect, and it is believed that birds destroy from 50 to 85 per cent of the hibernating pupæ. Thus they probably do more to check the increase of the codling moth than all other natural enemies combined.

MEANS OF ATTRACTING BIRDS TO ORCHARDS AND FARMS.

The destruction by birds of the codling moth, the boll weevil, and many other insect pests shows clearly not only that birds should be protected, but that efforts should be made to increase their numbers and so add to their effectiveness as auxiliaries of the farmer. During the year experiments have been initiated at the instance of the Survey, with a view to testing artificial nesting sites for this purpose. In Europe the use of artificial nests about houses and in orchards and groves has proved a great success. They not only attract numbers of birds like woodpeckers to a particular locality, where their services in destroying insects are much needed, but they actually increase the total number. Some such method as this is necessary in this country, where farmers and orchardists so generally plug up cavities in trees and trim off dead limbs, thus restricting the supply of nesting sites. This practice is actually diminishing the number of birds, like woodpeckers, bluebirds, and chickadees, that nest in cavities. The expenditure by the orchardist or the farmer of the small sums necessary to supply artificial bird boxes, whether purchased or homemade, will prove an exceedingly profitable investment, since it will increase the total number of birds and will attract to the places where they are most needed some of our most interesting and valuable species, whose destruction of insect pests will repay many times the small outlay made in their behalf.

BIOLOGICAL INVESTIGATIONS.

During the year, as usual, biological investigations covered a wide field and included several States. Field work was carried on in parts of Arizona, Arkansas, California, Illinois, Kentucky, Missouri, Montana, New Mexico, North Dakota, Oregon, Utah, and Wyoming. The data gathered enabled important corrections to be made in the zone map of the United States, a revised edition of which is now in press.

A report on the biological survey of Colorado is practically completed and will be published during the coming year. This includes a map of the State showing life and crop zones, with a general discussion of their relations, the adaptations to different crops of the

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several areas, and the species of plants and animals characterizing them. A full list of mammals of the State, with copious notes on habits, distribution, and economic relations, forms a part of the report.

A monograph of the wood rats of the genus *Neotoma* has been recently published as No. 31 of North American Fauna. Locally these animals do considerable damage, and a single individual in Alameda County, Cal., has been found by the Public Health and Marine-Hospital Service to be infected with plague, so that a knowledge of the distribution and habits of these mammals becomes doubly important.

A detailed survey of Wyoming, with special relation to its native mammals, birds, and distribution areas, is now being carried on as rapidly as possible, beginning with the sections in the Wind River and Bighorn valleys which are covered by the reclamation projects. The extent of the Upper Sonoran zone in these valleys, or the zone of corn and apples, and the crops best adapted to it, have been subjects of inquiry on the part of the Reclamation Service and of prospective settlers. At the request of the Director of the Reclamation Service a provisional report has been furnished on the life zones and crop adaptations in the Shoshone Project area, but more definite information is desired, and field work has been undertaken in order to define accurately the zone boundaries.

A few months of field work in New Mexico practically finished the survey of that territory, and a report on its life zones, mammals, and birds is now being prepared.

Work was continued in northern Arizona and southwestern Utah, but considerable field work is still necessary before the survey of these States can be completed.

The office work of mapping ranges of species of birds and mammals has been pushed vigorously, and the distribution of a large percentage of the mammals and birds of the United States has been mapped. These maps are constantly in use in planning field work, in investigations of beneficial or injurious species, and in other lines of work.

A large amount of information on the migration and distribution of North American birds has been gathered and tabulated for future reference. This information is in constant use in various reports and as a guide in formulating protective regulations for game and other useful birds and mammals.

Considerable field work has been done in the lower Mississippi Valley States, and a report on their faunal areas, birds, and mammals will be published as soon as possible after completion of the field work.

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Only a limited amount of work was done in California during the year, but important facts on distribution were ascertained, which enabled many corrections to be made in the zone map of the State.

GAME PRESERVATION AND INTRODUCTION.

With the increasing settlement of the country and its growing population, our big game animals constantly diminish in number, and unless suitable protection is given them the time is not far off when big game, except in game preserves, will be practically extinct. The chief function of the Federal Government in this connection is to stimulate and coordinate the action of the several States and to aid in solving the various protection problems as they arise. The same duties and similar problems are present in connection with the preservation of the birds of the country, both game and nongame. The danger of practical extermination is, however, more remote, especially in the case of nongame birds. To the Department, also, has been assigned the duty of preventing entry into the country of injurious birds and mammals. The danger that species will be imported that may, like the English sparrow, prove to be serious pests, is averted only by the system of inspection maintained at the principal ports of entry.

IMPORTATION OF BIRDS AND MAMMALS.

No serious attempt was made this year to introduce prohibited species. A mongoose surreptitiously entered at Everett, Wash., was discovered and killed a few weeks later, and two mongooses which it was sought to import from Habana were denied entry.

An incidental result of the establishment of a check on importations of eggs of game birds was the disclosure of the importation of terns' eggs from Jamaica for sale in the New York markets in a half-decomposed state as the eggs of Australian boobies. The Department united with the Treasury Department in suppressing this fraudulent traffic.

STARLING INVESTIGATION.

Reports have been received from time to time of the establishment and spread of the starlings that were liberated in Central Park, New York, twenty years ago. The latest observations show that these birds now range north to Springfield, Mass., and south to central New Jersey. As this bird has proved so great a pest in other countries that its further importation into the United States is specifically prohibited, an agent of the Department was directed to make a thorough investigation of its spread and the economic effect thereof. The results of this investigation will be given in my next report.

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GAME PROTECTION IN ALASKA.

Under the new Alaska game law 11 wardens have been appointed by the governor and 21 guides have been registered. Several hunting and shipping licenses were issued by the governor, the proceeds of which are paid directly into the United States Treasury. Twenty-four permits were issued by this Department for collection and export of scientific specimens, and 13 specimens and 8 packages of specimens were entered at Seattle, Wash., during the year.

An application for permission to purchase deerskins for the manufacture of gloves and novelties for export from the Territory was referred to the Attorney-General, who rendered an opinion that this Department has no authority to grant such permission.

INFORMATION CONCERNING GAME.

As last year, statistics were gathered of the deer killed east of the Mississippi. The number was found to be 57,500, substantially the same as in 1908–9. Through the cooperation of the Forest Service much information was acquired of the location of deer, antelope, mountain sheep, and other species of big game on National Forests. This work will be continued and the results will be reported at a future date.

The extent of the destruction of deer by wolves in Michigan, Wisconsin, and Minnesota was personally investigated by a member of the Biological Survey, and sufficient evidence was gathered to show that this problem demands serious attention. Its consideration will be continued, and the results will be reported during the coming year.

The information secured last year on pheasant propagation was published as a Farmers' Bulletin, the demand for which has shown the widespread interest in this subject. Owing to the persistent attempt to acclimatize the Hungarian partridge, which has been imported in very large numbers in the last two or three years, the question of the introduction of this European game bird was made the subject of special investigation, and the results were reported in the form of an article for the Yearbook.

A preliminary investigation of the growth and character of private game preserves in the United States formed the subject of a circular published during the year.

COOPERATIVE WORK.

As heretofore, the Department cooperated freely with various state game officials and organizations. Among the most important features of this work was the assistance rendered the State of Wisconsin in connection with its civil-service examinations for deputy wardenships.

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INTERSTATE COMMERCE.

Prosecutions were promptly begun under the new criminal code, effective January 1, 1910, which removed certain technical difficulties contained in the Lacey Act. In this connection investigation was made of certain shipping centers of the Middle West, heretofore the chief field of illegal traffic in game. As a result of these investigations and of the activity of local officials, the situation in this region is now practically under control.

PLUMAGE.

The Department has cooperated with Oregon, California, Missouri, and New York in an effective campaign against the use of plumage of native birds for millinery purposes. The broader question of international cooperation in the protection of the plumage birds of the world is steadily coming to the front. The latest important move is the appointment of an international committee on bird protection by the Fifth International Ornithological Congress, held at Berlin in the latter part of May. Thirteen countries are represented on this committee besides the United States, one of whose two representatives is an official of this Department.

BIRD RESERVATIONS.

During the year an inspection was made of several of the bird reservations by officers and agents of the Department. Wardens for sixteen reservations were appointed, and several of these were assigned the duty of studying special phases of bird life. Serious depredations on the Hawaiian Reservation were reported to the Department, and by arrangement with the Secretary of the Treasury a revenue cutter was dispatched to the scene in January. Twenty-three poachers were arrested on Laysan and Lisiansky islands, and 259,000 wings and a large quantity of other plumage were seized. The poachers were brought to Honolulu and were given a nominal sentence, proceedings being at once instituted against their employer.

NATIONAL BISON RANGE.

Thirty-seven pure-bred buffalo, most of them from the estate of C. C. Conrad, at Kalispell, Mont., were placed on the Montana Bison Range. An increase of eleven calves during the season raised the total number of the herd to 48. In addition to the buffalo, several white-tailed deer, presented by the city of Missoula, were placed on the range.

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DIVISION OF ACCOUNTS AND DISBURSEMENTS.

While the appropriations for the Department of Agriculture for the fiscal year 1910 were not much larger in the aggregate than those for the fiscal year 1909, the work of the Division of Accounts in connection with the disbursements for the later year was materially increased by reason of the fact that the appropriations for 1910 were divided into a great many more subappropriations, each necessitating the keeping of a separate account, than were the appropriations for 1909; in fact, the number of the 1910 subappropriations exceeded by approximately 150 per cent the number of the 1909 subappropriations.

During the year there were received, audited, and paid 56,415 accounts, amounting to $10,389,784.78, exclusive of approximately 48,584 accounts of the Forest Service, which received an administrative examination in the Division. Of these accounts, moreover, 4,828 were so-called "combined" accounts, in connection with which there was probably a saving of at least 24,140 checks, to say nothing of the saving of other clerical labor in connection therewith. There were also audited and sent to the Treasury for payment 1,473 accounts. In the payment of the accounts settled directly by the Division of Accounts it was necessary to draw 104 requisitions on the Treasury and subtreasuries and issue 108,757 checks. There were issued during the year 22,803 requisitions for supplies, 6,657 letters of authorization for travel, 32,418 requests for passenger travel, 553 requests on the Quartermaster-General for the transportation of government property, and 2,626 department bills of lading, while 87,500 letters were written or received in the ordinary transaction of business.

To carry on the work of the Department of Agriculture during the fiscal year ended June 30, 1910, Congress appropriated the sum of $17,029,036, an increase of $965,930 over the preceding year. Of this appropriation $12,225,036 covered the ordinary expenses of the Department, $3,000,000 the permanent annual expense for meat inspection, $1,344,000 the agricultural experiment stations, and $460,000 the printing and binding done under the Public Printer.

The disbursements of the Department for the fiscal year 1910 amounted to $13,794,231.97, and the greater part of the balance of $1,676,402.19 will be required for the settlement of outstanding liabilities. The apparent excess of disbursements over the appropriations for this fiscal year is due to unexpended balances brought forward from "Administration, etc., Forest Reserves," and other special appropriations.

The amount for rent of buildings in the District of Columbia for the several branches of the Department was $72,645.

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All accounts for the fiscal year 1908 having been settled, the unexpended balance of appropriations for that year, amounting to $442,538.63, was covered into the Treasury on June 30, 1910. The account for the fiscal year 1909 is still open.

The amount estimated for the fiscal year 1912 in the annual estimates for the regular appropriation bill is $16,693,686, which includes $1,440,000 for agricultural experiment stations and $400,000 for the enforcement of the so-called insecticide act of April 26, 1910. In addition there will be a permanent appropriation of $3,000,000 for meat inspection and $460,000 for printing and binding to be done under the Public Printer, making a grand total of $20,153,686.

The following are the more important points wherein the estimates for the fiscal year 1912 differ from the appropriations for the fiscal year 1911:

(1) In compliance with the provisions of the act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1911, requiring that detailed estimates shall be submitted for all executive officers, clerks, and employees below the grade of clerk, 2,989 employees, whose salaries aggregate $3,221,930, have been transferred from the lump-fund appropriations to the statutory rolls of the various Bureaus, at the same rate in each instance. The lump-fund rolls have been reduced accordingly, with the exception of the permanent appropriation "Meat Inspection, Bureau of Animal Industry," from which appropriation 543 employees, aggregating $480,020, have been transferred to the statutory roll, but the lump fund for meat inspection has not been reduced, as it is a permanent appropriation and as additional money is needed for meat-inspection work.

(2) An estimate of $65,000 is submitted under the Bureau of Animal Industry for the purchase of land for animal quarantine stations at the ports of Baltimore and Boston and for making improvements thereon.

(3) Under the Forest Service, the appropriation for Improvement of the National Forests has been consolidated with General Expenses. The provision under Forest Service in connection with refunds has been broadened to cover certain cases which the Comptroller of the Treasury has decided can not be refunded under the present law. The separate appropriations for the various National Forests have been discontinued and an estimate submitted for each of the six districts in which those forests are embraced.

(4) Under the Office of Experiment Stations there has been included in General Expenses the regular appropriation of $720,000 under the Adams Act, the Comptroller of the Treasury having held that the permanent appropriation therefor expires by limitation with the close of the fiscal year ending June 30, 1911. A new item for a Journal of Agricultural Research, $20,000, is submitted.

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By the terms of General Order No. 138, dated January 15, 1910, the Secretary of Agriculture placed the disbursing and accounting work of the Forest Service under the immediate supervision and direction of the Chief of the Division of Accounts and Disbursements, who also received authority to make, subject to the approval of the Secretary, such changes in the methods of accounting and disbursing in the Forest Service as might be deemed necessary from time to time. By the same order the fiscal agents of the Forest Service, both in Washington and at the district centers in Missoula, Mont., Denver, Colo., Albuquerque, N. Mex., Ogden, Utah, San Francisco, Cal., Portland, Oreg., and Madison, Wis., were made subject to the instructions of the Chief of the Division of Accounts in all matters pertaining to accounts and disbursements. The Agricultural Appropriation Act of May 26, 1910 (36 Stat., 416), supplemented the Secretary's action by transferring these fiscal agents from the Forest Service to the statutory roll of the Division of Accounts and Disbursements, thus completing the change which places the Forest Service on an equal footing with the other Bureaus in regard to fiscal matters and brings its accounting and disbursing work under the immediate supervision and direction of the Chief of the Division of Accounts and Disbursements, who is by statute the administrative officer of the fiscal affairs of the Department of Agriculture.

DIVISION OF PUBLICATIONS.

The publication work of the Department exceeded that of any previous year, comprising 1,982 different bulletins, circulars, and reports, of which 25,160,469 copies were printed for distribution to farmers in every section of the United States. This was an increase of 46½ per cent in the number of publications issued, and 41 per cent in the number of copies distributed, and this result was accomplished without any increase in the appropriation or in the force engaged in the execution of the work.

The publications give the results of investigations by scientists of the Department in their various lines of work. The popular bulletins and circulars give in plain language detailed information in regard to every phase of agriculture. The aim has been to meet the popular demand for information on any particular subject by publishing a bulletin or circular, in other words, to give the people, particularly the farmers, the information they desire and which they have a right to expect from the Department, which was founded and is supported for their benefit. Unfortunately the funds for printing are not sufficient to procure enough publications to fully supply the demand. Congress has, however, wisely provided a way by which applicants may always obtain publications after the Department's supply is exhausted and no funds are available to secure addi-

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tional copies, and that is by purchase from the Superintendent of Documents, under the law of January 12, 1895. During the year that official sold 147,327 documents of this Department and received therefor $18,398.18, the average price per copy being 12½ cents, being an increase of $2,005.08 over the sales during the previous year. Within five years the number of copies sold has increased over 205 per cent, while the amount received has increased more than 240 per cent. It is evident, therefore, that there is an increasing willingness on the part of the people to purchase the publications after their free distribution is no longer possible. A very good illustration is found in the sale of 47,148 copies of a Farmers' Bulletin on "Economical Use of Meat in the Home" after 900,000 copies had been distributed free.

FARMERS' BULLETINS.

Farmers' Bulletins continue to be in great favor with the people. The number of copies secured with the appropriation of $125,000 was 9,337,500, the average cost per copy being 1⅓ cents, as against 7,755,000 during the preceding year. The decision to reduce the size has made it possible to procure more copies. Forty-five new Farmers' Bulletins were issued during the year, of which 2,915,000 copies were printed, while the reprints of older bulletins still in demand aggregated 6,422,500 copies. The congressional distribution amounted to 6,449,589 copies.

The demand for these bulletins from educational institutions is increasing and is far in excess of the Department's ability to supply. On account of the elementary character of the bulletins they are considered suitable for text-books in schools of all grades, and such use of the information acquired by the Department should be encouraged. The inevitable result would be a tendency to increase interest in agriculture in the minds of the young, which would influence them to remain on the farm. With the present appropriation, however, it is not possible to fully comply with requests received from this source. It is a subject with which Senators, Representatives, and Delegates in Congress are familiar, and it will no doubt receive their serious consideration in connection with the appropriation for printing for the next fiscal year.

SCIENTIFIC AND TECHNICAL PUBLICATIONS.

Our scientists are constantly making new discoveries, which are given to the world in carefully prepared bulletins, for the printing of which $83,116.70 was expended, the number of copies of such publications aggregating 350,000. These bulletins were distributed to selected lists of instructors and to libraries both in this country and abroad, and constitute a permanent record of the achievements of the Department in scientific research. Instructions for applying and

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utilizing the results of scientific investigations are given in the smaller, popular publications, especially the Farmers' Bulletins, millions of which are annually printed and distributed.

ADMINISTRATIVE PUBLICATIONS.

With the growth of the Department there has been a corresponding increase in what may be called administrative publications, comprising reports required by Congress, for the printing of which $78,726.37 was expended, and food-inspection decisions, notices of judgment, and other documents for the guidance of employees and for the enforcement of laws, including also the necessary blanks for the transaction of the public business.

The great volume of the publication work of the Department, far exceeding that of any previous year, has been secured with an expenditure of $441,349.94 for printing and binding. Inasmuch as one of the functions of the Department is to disseminate the information it acquires, and since publications constitute the most effective medium of distribution to the people, the expense of such work is believed to be fully justified. The fact that the results were achieved at a saving to the Government bears testimony to the careful supervision given to this important branch of the work of the Department.

BUREAU OF STATISTICS

The most important duty of the Bureau of Statistics is to estimate the acreage of various crops at the beginning of each season, their condition at monthly intervals during the season, and the production after the harvest is gathered. Regular reports are made for the first of each month in the year, except February—eleven regular reports. In addition, reports on cotton are made for the 25th of May, June, July, August, September, and November, the last being the estimate of yield.

These reports are estimates based upon replies sent in by many thousands of voluntary but regularly constituted crop correspondents in answer to inquiry schedules sent out by the Bureau. During the year the schedules sent out for the regular monthly crop reports averaged about 65,000 a month, and the replies about 46,000 a month, each schedule having an average of about 40 questions. The schedules devoted exclusively to cotton averaged about 15,000 for each of the six months in which they are sent out, and the replies averaged 10,000. The tabulating, collating, and digesting of these replies involves an immense amount of work, and the amount is growing greater each year, as the work expands.

During the year several new lines of inquiry were added to the regular work of the crop-reporting service and some changes were

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made. In September, 1909, an estimate of the quantity of barley left on farms from the preceding year's crop was asked. The weight of wheat, corn, and oats was asked in November instead of December, and the weight of barley was added to the inquiry. The production of rice was asked in December instead of November, and the acreage of rice harvested was asked for the first time. Beginning in February, 1910, a special schedule has been sent out monthly inquiring the prices of a large number of farm products, in addition to the regular monthly inquiry concerning the prices of the staple crops and produce. In March, for the first time, the stocks of barley on farms was asked, as well as the percentage of the barley crop shipped out of the county in which grown. In April the mortality of spring lambs from disease and exposure was asked for the first time. The cotton schedules during the crop season of 1910 have contained an inquiry concerning the condition of the crop compared with condition on the same date last year, this in addition to the usual inquiry as to condition compared with a normal.

Several special inquiries were made during the year, as follows: (1) Stocks of potatoes in hands of growers and in hands of dealers on January 1, 1910. (2) Causes and extent of deviation from a normal production of various crops. (3) Monthly marketings by farmers of wheat, corn, oats, barley, flax, and hay.

The crop-reporting service is now giving general satisfaction. There has been practically no adverse criticism of our estimates during the year.

In addition to the present work of promulgating figures representing the condition of growing crops from month to month, it is contemplated during the present year to have the Crop Reporting Board give each month its estimate of the volume of the year's final production, as indicated by the condition figures. In other words, the condition figures will be interpreted in terms of yield.

When the figures of the new census are available the estimates of this Department relating to total acreage and production for each crop in each State for 1909 will be adjusted to conform to the census figures. The acreage estimates for 1910 will also be revised, using the census figures for 1909 as the basis. This will give us a new basis for our annual estimates, to be used until the next national agricultural census is made.

Aside from the crop reports, several important studies were made in the Bureau during the year. The prices of beef and pork were investigated, to ascertain the difference between the wholesale and retail prices in many cities. In connection with this study, the changes in prices of many farm products were examined for the period beginning with the low prices of the industrial depression of 1893–1897.

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A report on the marketing and transporting of grain in the region of the Great Lakes, made toward the close of the fiscal year, treats of the reduction in the cost of sending grain to market and the increased quantities handled during the last quarter century.

Preliminary work was done on an investigation to show the conditions affecting the cost of selling and delivering grain and live stock in the Pacific Coast States.

The nineteenth investigation of the wage rates paid to farm labor was well advanced at the close of the year. This inquiry has included many items of supplementary wages, such as house rent, firewood, and laundry work, often not considered in studies of money wages. The cost of living of the farm laborer, compared with that of employees in the cities, has also been considered as affecting his real wages.

A study of the dates of planting and harvesting crops throughout the world has been under way during the year, with the cooperation of many experts in other branches of the Department, and gives promise of interesting results.

LIBRARY.

Like everything else about the Department, the Library is for service, and as a reference library its first duty is to the Department's employees. But it is also able to aid the scientists in the agricultural colleges and experiment stations, to whom it made 548 loans of books from its shelves, which is a slight return for the many favors and benefits which scientists connected with the Department have enjoyed through the generous policy of other libraries in lending books for use in the work of the Department, amounting to 4,701 volumes.

The accessions of books, pamphlets, and maps totaled 8,156, of which 3,646 were gifts, making the total number of recorded books and pamphlets available for use of investigators 109,630.

The increasing interest in agricultural libraries and agricultural literature on the part of librarians and their efforts to serve the farmer is worthy of note. At the seventh annual meeting of the League of Library Commissions, held in connection with the American Library Association Conference at Mackinac Island, June 30, 1910, one session was devoted to the general subject of commission work with the farmer, and it is hoped that a permanent agricultural libraries section will be formed, which will be the means of bringing about closer cooperation among agricultural libraries, of furthering their advancement, and of stimulating interest in agricultural literature.

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OFFICE OF EXPERIMENT STATIONS.

RELATIONS WITH AGRICULTURAL EXPERIMENT STATIONS.

The sixty-two agricultural experiment stations in the several States and Territories have been actively at work in the interest of the farmers and horticulturists during the past year. Fifty-five of these stations receive appropriations provided for by acts of Congress, which amounted to $1,344,000 for the fiscal year ended June 30, 1910. The state legislatures made appropriations for their work amounting to over $1,000,000, and additional sums were received from fees for analyses of fertilizers, sales of farm products, and other local sources aggregating about $750,000. The total annual revenue of the stations is now over $3,000,000, as compared with half that sum in 1905.

In 1906 Congress passed the Adams Act, by which the stations were granted additional funds from the National Treasury. Under the terms of this act this grant was to be increased annually for five years. The maximum has now been reached and the stations will receive $720,000 under the Adams Act during the current fiscal year. The liberal policy of Congress toward the stations has resulted in much larger appropriations by the States and a material increase of their revenues from other sources. The Adams fund is restricted in its use to original research. The state funds are mainly used for the more practical work, including the maintenance of substations, demonstration fields, agricultural surveys, and a great variety of local experiments, as well as for printing and disseminating the results of the experiments. By this cooperation of the National and State governments in fostering the stations, their operations have been greatly strengthened and the results of their work have been brought more directly to the attention of the farmers in every part of the United States.

The Adams Act has enabled the stations to attack a large number of the more fundamental and difficult problems of our agriculture. The scientific work of the stations has been greatly broadened and increased in efficiency. A much more solid foundation on which to base a rational practice of agriculture is thus being established. According to the Comptroller's decision the appropriations under the Adams Act were limited by the terms of the act to a period of five years. It will therefore be necessary for Congress to take further action if the stations are to continue to receive this needed increase. It is believed that the appropriation is of great importance to our agriculture and that without it the work of our stations would be seriously crippled. I have included it in the estimates submitted for the ensuing fiscal year.

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The stations annually issue about 500 publications, which are regularly sent to over 900,000 addresses, mainly those of farmers. The practical results of station work are also widely disseminated through the public press. They are carried out to the farmers through the farmers' institutes and other forms of extension work conducted by the agricultural colleges and the state departments of agriculture. While the task of effectively reaching the many millions of our rural people with information which may lead to the improvement of agricultural practice is an enormous one and will not be thoroughly performed for many years, great progress has been made in this direction during the past decade. The efforts of the stations in the dissemination of information have been mainly spent in popularizing their work and their funds for printing are still inadequate to meet the growing demands of our agricultural people.

Meanwhile less attention has been given to the appropriate publication of the scientific work of the stations. This material has either been combined with the practical in popular publications, or issued in separate series, or published in abbreviated form through scientific journals. Recently there has been a growing tendency to publish such material in foreign journals in the belief that thus it is more surely brought to the attention of the scientific world.

The general result of the present method of publication of the scientific work of our stations is very unsatisfactory and from the standpoint of National pride even humiliating. We have the most comprehensive system of agricultural research in the world. The amount and value of the scientific work of the stations, on which their practical results are based, are very great, yet the scientific publications of our stations are so fragmentary and scattered that it is very difficult even for workers in similar lines in this country to obtain them in any complete way, and to the great world of science they are largely unknown. To remedy this defect and put the scientific work of the American stations in the right light before the world the Association of American Agricultural Colleges and Experiment Stations has asked my cooperation in laying before Congress a proposition to establish under National authority a central medium for the publication of original reports of the scientific work of the stations. Believing that this is a matter of much importance and that it is worthy of careful consideration by the Congress, I have included an item proposing an appropriation for this purpose in the estimates for the ensuing fiscal year.

In the conservation of our natural resources the experiment stations are doing very important work. The greatest natural resource is the productive power of the soils, and the stations throughout the country are making every effort to devise efficient means for the maintenance and increase of the fertility of the land. The investigations in prog-

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ress include studies of all problems bearing on this point, such as the economic use of fertilizers, the retention of the proper quantity of moisture by the soil and its use by the growing crop, rotative cropping, green manuring, especially with leguminous plants, the action of bacteria in relation to soil fertility, etc. The different types of soils are studied in regard to the reduction of fertility by cultivation, and many interesting and valuable facts are being brought out. To give an instance of this kind, the Nebraska station found that the cultivated loess soils of the State contained as much phosphoric acid, potash, and lime in the surface as in the subsoil, but that the content of nitrogen, humus, and unhumified organic matter decreases rapidly from the surface downward. This indicates that the maintenance of fertility in so far as chemical composition is concerned is essentially a matter of keeping up the supply of total organic matter.

The extent to which some of the experiment stations are extending their work throughout their States is illustrated by one station, which has two regular substations, and the management of twenty-five county and asylum farms used for experiment and demonstration purposes, had the past year 1,600 centers where its pedigreed barley was being grown for breeding and increase, and over 20,000 boys growing corn and barley for prizes. Among the prizes are scholarships covering all the expenses of a week's attendance on a young people's corn and grain course at the college, 20 boys receiving such prizes and attending the course last year.

More attention is being given from year to year to crop production under dry-farming conditions, which is essentially a matter of moisture conservation. The stations have done valuable work along this line, and in many States this is given recognition by the establishment and maintenance of dry-farming experiment stations at the expense of the State, but under the general direction of the central station receiving the Federal funds. In many instances the work of these dry-farming stations is carried on in cooperation with this Department. This work is doing much to put farming in the dry regions on a safe and enduring basis.

The New Jersey station has shown that nonleguminous plants, such as corn and cereals, grown in close association with legumes, benefit in some manner by the nitrogen-fixing ability of the legumes. This benefit is quite marked; but the channel through which it is exerted has not yet been determined.

The experiment stations in several States are supplementing and extending the Department's work on hog-cholera vaccine by testing its use extensively and manufacturing it for distribution under state funds.

Work at one station for nine years has demonstrated wide rations to be more profitable and economical for dairy cows than the theoret-

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ical narrow ration, and this conclusion is confirmed by extensive investigations at the Minnesota station, where the health and production of cows from calfhood has been studied and checked by laboratory examinations.

The extensive dairy investigations carried on by the Missouri station in cooperation with the Department have thrown much light on the efficiency of food in milk and butter production.

The rôle of bacteria in relation to the keeping quality of milk and butter has been investigated with great thoroughness at the Michigan station, and many facts have been established which have an important bearing upon practical dairy methods. Most interesting facts have been brought out in these investigations with reference to the varying behavior of the organisms found in milk and butter when working alone or in association with one another and in their resistant power under different conditions. It has been shown that a large proportion of the harmful organisms succumb to ordinary sanitary dairy methods; but one group has been isolated and studied which not only survives but is active in a 12 per cent salt solution at $-6°$ C.

The Iowa station, among other things of immediate practical value, has shown the expensiveness of condimental foods as compared with standard feeds of equal nutritive value and the danger of the formation of urinary calculi in long-continued feeding of roots to breeding sheep. This station has also demonstrated a number of efficient substitutes for oats in rations for horses.

In pollination experiments with apples at the Oregon station only 15 out of 87 varieties were self-fertile, and the self-fertile varieties were improved in size by cross-pollination. A number of suitable pollenizers for commercial varieties of apples have been determined. The possible variation of the same kind of fruit grown in different climates is indicated by some work recently reported by the Massachusetts station, where Ben Davis apples from various sections of the United States and Canada were collected and studied. Generally speaking, this variety gradually becomes more elongated in form the farther north it is grown. Upon correlating the variations in fruit characteristics with the variations in meteorological data, it appears that the poor quality of the northern-grown Ben Davis is due to an insufficient amount of heat to fully develop the fruit. Apple orcharding in the New England States has recently been given marked attention by the stations, with a view of extending the industry through improved methods of culture, harvesting, packing, grading, and cooperative marketing, so successfully employed in the apple district of the Northwest.

Considerable work has been done at both the South and North Carolina stations leading to a better knowledge of the Scuppernong and other Rotundifolia grapes which are found to be especially

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adapted to the climatic and soil conditions of the Coastal Plain region from southeastern Virginia to Texas. Demonstrations conducted at the South Carolina station have shown that the injurious results which have often followed the pruning of these grapes can be avoided if the pruning is done not later than the months of October and November. Extensive experiments made at the North Carolina station lead to the conclusion that the important varieties of Rotundifolia grapes are self-sterile and that to insure regular crops a sufficient number of staminate, or male, vines must be planted in the vineyards.

At the New York state station a new disease of cucumbers and muskmelons in the greenhouse was worked out and its cause determined. The fungus has since appeared upon tomatoes both in this country and in Europe. In cooperation with the Vermont station, the pathogenicity of the organisms causing the soft rots of a number of fruits and vegetables has been thoroughly worked out.

At the Arizona station it has been found that date ripening may be hastened by spraying the immature fruit with a solution of acetic acid, thus causing choice varieties to ripen in that region. This station has also shown that many varieties of olives, when grown under Arizona conditions, are well adapted to oil making and that when properly made from them the oil may be of the very finest quality. The recoverable oil content of the Arizona olive compares favorably with that of the California olive.

The Florida station has studied the effect of fertilizers upon the quality of pineapples. In general it has been found that the eating quality of pineapples, so far as their sugar and acid content is concerned, does not appear to be affected by the kind of fertilizer used, although their shipping quality may be thus influenced.

The Massachusetts station finds that many of the more serious diseases of greenhouse crops are due to faulty environment and can be successfully controlled by proper regulation of the heat, light, humidity, circulation of the air, and condition of the soil. If this is skillfully done spraying greenhouse crops is considered wholly unnecessary.

THE AGRICULTURAL COLLEGES AND SCHOOLS.

The growth of sentiment in favor of elementary and secondary as well as collegiate instruction in agriculture has been more rapid than even the most sanguine friends of agricultural education had anticipated. Since October, 1908, the number of institutions in the United States giving instruction in agriculture has increased from 545 to 875, or more than 60 per cent in nineteen months.

The most notable advance in secondary agricultural education was in the number of departments of agricultural instruction estab-

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lished in public high schools with the aid of state appropriations. Five such departments were established in Alabama high schools, 8 in Louisiana, 10 in Minnesota, 5 in Mississippi, and 10 in Virginia. The importance attached to these new departments is indicated by the fact that in many instances the schools adopted the names of the departments and were called agricultural high schools.

There has also been a notable increase in the number of institutions conducting teacher-training courses in agriculture. The total number of such institutions is now 214, including 30 land-grant colleges, 156 state and county normal schools, and 28 negro schools. Nineteen of the land-grant colleges offer regular courses for teachers of agriculture and 24 of them conduct summer schools for teachers. This general movement for the training of teachers of agriculture is significant of the importance now attached to the agricultural education movement.

The agricultural colleges have had a successful year and a large attendance of students. Their graduates have quite generally chosen agricultural pursuits, and have found no difficulty in securing employment. As an indication of this, 30 of the 38 graduates of the animal husbandry course in Iowa State College will engage in farming, 4 will teach in agricultural colleges, and 1 will go into agricultural journalism. Only 3 of these graduates were looking for positions at commencement time and these wanted to become farm managers.

The fourth session of the Graduate School of Agriculture was held at the Iowa State College, Ames, Iowa, in July, 1910. The enrollment was larger than at any previous session and the interest manifested by the students has never been surpassed. There were 207 students from 39 States and the District of Columbia and 6 foreign countries. Eight general lines of instruction were given and important conferences on agricultural extension, agricultural journalism, and elementary and secondary instruction in agriculture were held. The faculty numbered 57, in addition to 17 speakers at special conferences. Eleven members of the faculty were from this Department and the Director of the Office of Experiment Stations was dean of the graduate school.

FARMERS' INSTITUTES AND AGRICULTURAL EXTENSION WORK.

Farmers' institutes are now organized in every State, with responsible directors in charge and a corps of teachers aggregating over 1,000 specialists to give instruction. There was appropriated for carrying on the work last year about $432,000, an increase of $86,000 over the appropriation of the year before. There were held 5,651 regular institute meetings, composed of 16,586 sessions of one-half day each, with a total attendance of 2,395,908. In addition to carrying on the work of the regular institutes the States have been main-

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taining numerous special meetings of institute character. Several of these special forms of activity are rapidly becoming of such importance as to require separate organizations specially equipped for the service that each interest requires. One of these special forms is the movable school of agriculture. Ninety-nine of these schools were held last year, with an attendance of 65,977.

Field demonstrations also are rapidly coming into use as methods of teaching agriculture to farming people. One State reports having held 67 of these demonstrations, with a registered attendance of 21,775 persons. Others have held meetings of similar character with great advantage. The agricultural train is another form of institute activity that has recently developed and promises to be an effective means for disseminating agricultural information. Twenty-eight trains are reported to have been run during the year by 18 States, with an attendance of 189,645.

Fifteen States held 444 institutes for women, with an attendance of 4,850. Institutes for women, because of their importance, ought to have and doubtless will receive much recognition in future extension work, and institute workers should devote themselves with as great earnestness and energy to the development of this form of extension activity as they have exhibited in developing institutes for men.

One hundred and sixty sessions of institutes for young people were held, with an attendance of 21,422. When it is considered that 94 out of every 100 children finish their education with the district school, and that the large majority of these do not continue beyond the sixth grade, it is important for the future of agriculture that opportunity be given for young people who live in the country and have left the public school, and from whose ranks the future farmers and their wives must be supplied, to be taught the latest and most improved methods for conducting agricultural operations. Hitherto the large majority of young people in the country over 14 years of age have been without means of instruction along agricultural lines. To supply this need the farmers' institute authorities in a number of the States have organized institutes for youth between the ages of 14 and 19 years who have left the public schools and are about choosing a life pursuit. These institutes differ from boys' and girls' clubs as organized by the public schools in that they are officered by adults, and their instructors are capable specialists of the same qualifications as those who lecture before the farmers' institutes for adults. The instruction also is altogether vocational, and is intended to show how to make money in the business of agriculture.

The agricultural colleges and experiment stations have continued to aid the institutes by detailing members of their faculties and station staffs for lecture service. Four hundred and eighty of these

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lecturers, representing the agricultural colleges and experiment stations in 43 States, were engaged in institute work last year. Thirty-nine of these States report the days of service contributed by the lecturers at 4,780—a much larger contribution of time by these institutions to institute work than during any previous year.

THE DEPARTMENT'S INSULAR AGRICULTURAL EXPERIMENT STATIONS.

The policy of conducting investigations looking to the diversification of agriculture has been continued as before. Each station has its special problems, and satisfactory progress has been reported on the various lines of work.

In Alaska a demonstration is being made of the possibilities of agriculture in that region. Cereal breeding, testing of varieties of grain, methods of culture, and the introduction of new varieties of grains and forage plants are made the important investigations at the Rampart and Fairbanks stations, and it is gratifying to note the success attained at the Rampart station in the introduction of hardy early-maturing varieties of barley, oats, winter wheat, and winter rye. In addition, by cross-fertilization a number of new varieties of barley and oats have been developed, some of which were grown this year for the first time. About 65 acres were cropped this year, and data are being collected to show the possibility of farming in the Yukon Valley. The first self-binding reaper in Alaska was sent to the Fairbanks station this summer. With the success thus far indicated a demand has come for information regarding agricultural lands, and a reconnaissance is being made of a number of regions preliminary to a detailed land survey by the Department of the Interior. The horticultural investigations are being extended, and the plant-breeding work is beginning to give results. Of the large number of hybrid strawberries made at the Sitka station at least a score have proved thoroughly adapted to the coast region of Alaska. They are hardy, prolific, and the berries are of large size, good substance, and excellent quality. The stock-breeding work at Kodiak has been extended to include sheep. Forty Cotswold-Merino ewes and two Lincoln rams have been purchased for the station, and the success of this experiment is awaited with interest. If sheep can be successfully wintered, there are large areas in Alaska adapted to their production. Experiments with some of the hardy breeds from Scotland and Iceland are contemplated if the preliminary trials prove successful. The Galloway cattle continue to give satisfactory results at Kodiak, and at the end of the fiscal year the herd consisted of 61 pure-bred animals of all ages.

Great interest has been aroused in Hawaii by the cotton experiments inaugurated by the station, and the growing of cotton in

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commercial quantities appears to be assured. The cotton plant requires less water than sugar cane, and already over 500 acres of cotton have been planted on sugar plantations where irrigation water was deficient. Sea Island and Caravonica varieties are the chief ones used, and their cultivation as perennials is intended. By pruning at the proper season the time of picking can be made to articulate very well with the cane-grinding season, when there is the greatest demand for labor on the plantations. The adaptability of this crop to the owner of a small tract of land is being demonstrated. Breeding experiments with cotton are being continued, and by vegetative propagation some desirable strains are being rapidly developed, without the possibility of undesirable crosses through pollination. The investigations on rice have resulted in some new varieties produced by breeding experiments that exceed any in common use. They have also shown the value of ammonium sulphate as a fertilizer for the rice crop. The visit of the agronomist to Japan last season resulted in the introduction of a number of newly-developed varieties of rice, some of which appear very promising. The pineapple soil studies have been continued, and it has been found that where the manganese content is not too high the use of suitable fertilizers will correct the injury due to manganese. A more serious pineapple trouble in Hawaii has been found, due to a lack of aeration of the soil, and studies to correct this condition are in progress. A study of the pineapple fruit has shown the influence of ripeness on the sugar content. There appears to be no increase in the amount of sugar in a fruit after it is cut, although the fruit will become yellow and soft, hence the importance of the stage of maturity on the quality of the fruit. The rubber-tapping experiments have been continued, and the profitableness of growing Ceara rubber has been shown. In connection with the rubber investigations it has been found possible to keep down all weed growth by spraying between the trees with arsenite of soda. A demonstration on 400 acres showed the success of the treatment at the low cost of $1.25 per acre.

In Porto Rico one of the most striking results of the investigations during the past year was the determination of the cause of the chlorosis in pineapple plants. This rather serious trouble was found to be due to the abundance of calcium carbonate in the soil, and it was found inadvisable to plant pineapples on soils containing more than 5 per cent of calcium carbonate. The work on sick soils, due to superabundant bacteria, has been continued, and disinfection by chemicals or by frequent deep plowing has proved of value in correcting the trouble. The rapidly developing citrus industry has necessitated much attention to the insect and fungus pests of these crops, and some of the results of the investigations have been issued. The great

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importance of windbreaks in connection with citrus growing in Porto Rico has been fully demonstrated. Studies are being made of the pests of other economic plants, especial attention being given to those occurring on coffee. The experiments on the introduction and cultivation of some of the more valuable coffees of other regions have been continued, and the station is distributing for planting limited quantities of five of the highest-priced coffees of the world. Of some of these, three-year-old trees bore this year more than a pound of clean coffee to the tree. The flavor and aroma, so far as tested, have been pronounced equal to the original stock. The work of the station on the importation and breeding of live stock has been very successful and some results are being shown. The progeny of American saddle-bred horses bred to native mares have matured into handsome animals that command very high prices. Crossbred zebu bulls and woolless sheep have been introduced and have developed splendidly. They will be used to improve the cattle and sheep stock of the island. Similar work is being carried on with swine and poultry, and the station's excess stock of all kinds is in great demand by planters and breeders. The cooperative work with planters and with the insular authorities has been extended, and the relation of the station's work to the island's development is becoming well recognized and appreciated.

The agricultural experiment station of Guam now has a permanent location, the negotiations for its purchase having been completed during the year. Much progress has been made in bringing the land under cultivation and in the erection of necessary buildings. The greater portion of the land has been planted to forage crops of various kinds preliminary to experiments in the introduction and breeding of live stock. The experimental work undertaken has been of the simplest kind, and ocular demonstrations are being made of the value of improved varieties of standard crops, the introduction of others, and the necessity for better methods of cultivation of all crops. Some of the introductions have proved of great value and readily adapted to their new location. Among those with which the most striking results have been obtained are Kafir corn, sweet potatoes, avocados, and pineapples from Hawaii, guinea grass, and the large water grass, *Paspalum dilatatum*. All of these thrive well and have proved very satisfactory, and they are being distributed for planting as rapidly as possible. A number of crops have been found to ratoon or sucker after the plants are cut, and advantage is taken of this to grow some of them as perennials, although they are usually grown as annuals. Various leguminous plants have been introduced; among them cowpeas, velvet beans, soy beans, and peanuts seem quite promising. A demonstration of the value of these crops in enriching the soil is in progress. Attention is being given to the cul-

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tivation of maize, considerable of that crop being already grown and consumed in Guam. Comparisons are being made of varieties, and studies are in progress to determine a practical method of storing this and other grains against the losses due to weevil, fungi, etc. For the short time the station has been established it has interested the people and gained their confidence to a remarkable extent. They are desirous of obtaining seeds of plants whose value they can see. Especially noteworthy is the interest taken in new implements and methods of culture. A small cultivator attracted attention, and through our special agent a number were secured and sold to farmers at cost. With one of these cultivators a man with the aid of a carabao can cultivate as much land as would require ten men with their old implements. The willingness of the people to abandon their old conservatism in this regard appears to augur well for the future influence of the station in restoring and developing agriculture on the island of Guam.

NUTRITION INVESTIGATIONS.

The investigations in human nutrition carried on in the Office of Experiment Stations were instituted in 1894 at the time when the agricultural experiment stations in the different States were authorized by Congress to cooperate with the Secretary of Agriculture in studying the food and nutrition of man. For a number of years the investigations involved cooperation with agricultural colleges, experiment stations, and other institutions, but for the past few years the work has centered in Washington, quarters for it having been provided in the new Department of Agriculture building.

Briefly stated, the purpose of the nutrition investigations is to study various aspects of the problem of the value for human food of agricultural products, both animal and vegetable. In carrying out this project many studies have been made which have to do with the nutritive value of flour and other cereal products, the relative nutritive value of meats of different kinds and cuts, and the value as food of fruits, nuts, and other food products. The ease and thoroughness of digestion of many kinds of animal and vegetable foods have been studied, as have also methods of preparing food for the table and other technical questions and practical problems of general interest.

One of the important features of the nutrition investigations has been the elaboration of methods and apparatus for the experimental study of nutrition problems. Particularly important is the respiration calorimeter, an instrument of great precision, which permits of the measurement of the total income and outgo of matter and energy in the human body and is adapted to the study of a great variety of questions. It should be mentioned that it is useful not alone for

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studying human nutrition problems, but is equally well adapted to the study of the feeding of domestic animals, as is shown by the results obtained in the cooperative studies undertaken by the Bureau of Animal Industry of this Department and the Pennsylvania Agricultural College and Experiment Station with a respiration calorimeter especially adapted to such work. Indeed, the devising and perfecting of this apparatus may be justly regarded as a very important contribution to general agricultural science.

The respiration calorimeter which has been installed in the new Department of Agriculture building and is being used in the study of the relative ease of digestion of cheese in comparison with meat and of other important questions, has many new features which make for accuracy and ease of operation. It has already been learned from digestion experiments carried on as a part of the nutrition investigations that cheese is digested very thoroughly by the average individual and that it is not a common cause of physiological disturbance, as is often claimed. Results obtained in recent tests with the respiration calorimeter indicate that when eaten in ordinary amounts cheese does not require greater expenditure of energy for its digestion than does meat in comparable quantities, and so it seems fair to conclude from experimental data now available that this food material is worthy to rank as a staple article of diet suitable for use in quantity. Such a conclusion is of great importance to the American dairy interests, since it has been the American custom hitherto to regard cheese as something to be eaten in small quantities for its agreeable flavor rather than a material suited to form an integral part of a meal. To round out this work with cheese, tests are now being carried on having for their object the accumulation of data regarding its preparation for the table in palatable ways, so that the housewife who wishes to use this food, which supplies such a large proportion of protein and fat at a reasonable price, may have abundant and reliable information as to its possible use as a welcome and integral part of the diet.

It has always been a fact that one of the most interesting features of the Department of Agriculture work is that the Department is so generally regarded as a bureau of information by the people at large. This turning to the Department for information is as marked in the case of nutrition as in other branches of Department work. The number of farmer's wives and other housekeepers and of teachers and individuals who submit their problems to the Department and ask for data and suggestions regarding food, diet, and other home problems is very large and constantly increasing. This means that directly and personally, as well as by means of its publications, experimental work, and its close relations with educational institutions, the Department comes in touch with the people of the United

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States and is able to demonstrate that its nutrition work is of interest and practical value, as well as of scientific importance.

IRRIGATION INVESTIGATIONS.

During the past year the Office of Experiment Stations, while maintaining most of the old lines of work in its irrigation investigations, has endeavored to modify its plans so as to meet the demands for information on the new issues which are constantly arising.

This is particularly true as regards the assistance which has been given to the new settlers. The task of converting desert land into productive fields is not easy under the most favorable conditions, but when the one who attempts it knows little or nothing about irrigated farming the difficulties are greatly increased. Those in charge of irrigation investigations in the West have, therefore, devoted a considerable portion of their time to advising the newcomers as to the methods best adapted to their individual needs. This personal advice, supplemented by practical bulletins, has done much to prevent mistakes and to safeguard the settler from either partial or total failure.

So widespread an interest has of late been created in the East regarding irrigation in the West that the Department has been flooded with requests for information as to the conditions and possibilities of different districts. The series of bulletins on irrigation prepared by this Department in cooperation with western state engineers and others has done much to furnish the information desired. Of this series, ten bulletins have already been published and four more are being prepared. When complete, the irrigation conditions as regards the climate, soil, water supply, extent of land, crops, etc., of each State and Territory in the West will be accurately described.

In former days water for irrigation purposes was both plentiful and cheap and in attempting to use it much was wasted. In many parts of the West the old wasteful methods still prevail, although the value of water has increased many fold. The results of seepage measurements of irrigation channels obtained by the Department, coupled with the high price of water rights and the rise in value of agricultural products, have induced many companies to line their main canals. As a result, many channels which formerly lost from 20 to 30 per cent of their total flow are now practically watertight. In many cases such improvements would not have been made if the attention of the managers had not been called by our engineers to the large losses sustained and the best means of preventing this waste. In other cases farmers used large amounts of water without realizing how excessive was the use until measurements were taken. When the irrigators of the San Joaquin Valley in California first began to apply water on what had been dry-farmed grain fields they frequently

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used over 9 feet. Now about one-third of this amount is found to be ample. The water users of Greeley and neighboring districts in Colorado used to think their crops would burn up unless they had a miner's inch of water to the acre. Now they are raising crops on the same ground that are worth about four times as much with one-fourth the water formerly used. They are learning that cultivation takes the place of irrigation to a great extent.

The demonstration farms established in former years have been maintained. These have been of great value during the past year in showing, among other things, the benefits to be derived from the use of scanty water supplies on small fields in connection with dry farming. At the Cheyenne farm during the past season, 54 bushels of oats were raised per acre with the application of only 8 inches of irrigation water, while the crop grown without irrigation was practically a failure. Alfalfa yielded 4,805 pounds of hay per acre with the application of 13.3 inches, while the unirrigated field yielded only 550 pounds. Beardless barley, with the application of 9.7 inches of water, yielded 31 bushels per acre; that unirrigated and raised on summer fallowed ground yielded only 2½ bushels. At Gooding, Idaho, 8.8 tons of red clover was harvested from land which received only 19 inches of irrigation water. These results show what can be done with a limited supply of water when properly applied.

The need of investigating the questions which arise in connection with the use of water in irrigation is so keenly felt by the people of the West that several Western States are now cooperating with the Department in the prosecution of these studies. For years the States of California and Utah have given dollar for dollar for the purpose of carrying on this work. The States of Idaho and Wyoming are likewise contributing considerable sums for the cooperative investigation of problems peculiar to these States. In time it is expected that many other States will enter into cooperative arrangements with the Department for the investigation of irrigation problems.

In many sections of Louisiana, Arkansas, and Mississippi the ravages of the boll weevil have made the growing of cotton unprofitable and the producers are substituting other crops. Experiments with the growing of rice have proved that it can be grown there profitably. In consequence, large areas of cotton land have been planted to rice during the past season and costly failures are quite certain to result unless proper methods are followed. These farmers as a rule know but little about pumping plants, the building of levees for rice irrigation, the quantity of water to apply, and the proper time of application. It has therefore been found necessary to detail a man to this field to devote his entire time to a study of rice irrigation and to work out, if possible by experiments, better and cheaper

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methods than those now in vogue. A Farmers' Bulletin on the irrigation of rice for the benefit of beginners will soon be published.

IRRIGATION IN THE HUMID REGION.

The widespread drought of the past summer throughout most of the humid region has greatly increased the interest in the irrigation of gardens, truck farms, and orchards, and the demands on the one agent we have been able to detail to this work have been far greater than he could meet. The advantage of irrigation as an insurance against the long dry spells for some of the common crops has been brought out in a striking manner on several farms where experiments were conducted this summer. As a result of adding both moisture and fertilizer to the soil on experimental plats in Iowa by irrigating with sewage, the yield of beets was increased one and one-half times, that of timothy was doubled, while the yield of bluegrass was ten times as great as on the nonirrigated plats.

At Neenah, Wis., it was found that irrigation prolonged the bearing season of strawberries ten days and increased the yield 50 per cent. On the same field irrigated carrots yielded 50 per cent and irrigated onions 150 per cent more than the nonirrigated crops.

The utilization of a flowing well at Albany, Ga., in irrigating corn the past season quadrupled the yield, and as the result of an experiment conducted by this Department wells are now being sunk in this district for the irrigation of corn, cotton, and legumes in order to insure against droughts, to introduce scientific rotation, and to increase the profits from small farms.

DRAINAGE INVESTIGATIONS.

During the past five years the Office of Experiment Stations has made surveys and plans for the improvement of more than 9,000,000 acres by drainage. This has been done at an expense of about 3 cents per acre. When these lands are fully improved and utilized the crops raised on them will annually add many millions to the country's wealth and furnish food for many thousands of men.

OFFICE OF PUBLIC ROADS.

PRESENT STATUS OF ROAD IMPROVEMENT.

By reason of a rather remarkable combination of conditions, the immediate present may be considered the most important period in the history of road improvement in the United States. The old systems of road administration, involving the principle of extreme localization, are fast breaking up, and new systems, involving the principle of centralization, are taking their place. Road administration is, therefore, in a transitional or formative stage, and it is of the utmost importance that the movement be directed along right lines.

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It is a curious coincidence that the introduction of the motor vehicle at about the time when these changes in administration began has brought about traffic conditions which have necessitated an equally radical departure from old methods of construction and maintenance. It will thus be seen that the entire subject of road improvement, involving administration, construction, and maintenance, is passing through an exceedingly important period, in which the educational and scientfic work of this branch of the Government service should prove of the greatest value.

OBJECT-LESSON AND EXPERIMENTAL ROADS.

During the past year the Office of Public Roads has continued giving instruction in the methods of road building peculiarly adapted to each locality. This instruction has been given through the medium of object-lesson roads, built at local expense, under the supervision of an engineer from the Office. That results of considerable magnitude have been accomplished under this project is shown by the fact that during the past fiscal year there were completed 1,007,570 square yards of road, equivalent to about 114 miles of road 15 feet wide, as compared with 690,000 square yards for the previous fiscal year. Viewed as a construction record alone, this would constitute an excellent showing, but, when it is considered that this mileage was made up of 55 object-lesson roads, each constituting a miniature school of road building, comprising 10 distinct types of construction, it must be evident that this feature of the Department's work is a powerful factor in the promotion of the movement for the betterment of the public roads.

It is the practice of the Office to inspect from time to time the various object-lesson and experimental roads, and to ascertain what has been the effect of their construction upon the locality. Last year 22 object-lesson roads, aggregating about 22 miles, were inspected, and it was found upon the actual reports of the local officials in charge that these 22 short sections of road had directly resulted in the building of 730 miles of additional roads according to the same method, and had brought about the expenditure, through bond issues, of $1,500,000.

ADVISORY WORK.

The advisory work of the Office during the year covered a wide field, relating to construction of various types of road, surveys, use of convicts in road work, bridge construction, maintenance, use of the split-log drag, road materials, effect of automobiles on roads, the issuance of bonds for road improvement, the drainage of roads, and other work along similar lines. In all, about 250 assignments were made under this project, showing an increase of about 70 per cent over the amount of work performed during the preceding fiscal year. This is a satisfactory showing, not alone because of the increased

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amount of work, but because it indicates that localities have come to look upon the Office of Public Roads as a body of consulting engineers and experts who are ready and able to aid them in the solution of their most difficult road problems.

LECTURES, ADDRESSES, AND PAPERS.

The educational work of the Office, including lectures, addresses, and papers, has been greatly facilitated and broadened through an extensive lecture program. These lectures are in almost all cases given by the same men who actually direct the investigative work and the construction and maintenance of the object-lesson roads, and are therefore of a practical, instructive character. During the year 523 lectures and addresses were given throughout the United States, as compared with 185 for the previous year.

INSTRUCTION IN HIGHWAY ENGINEERING.

The Office has greatly enlarged and broadened the project relating to the instruction of engineer students in practical methods of road construction and maintenance. The plan provides for the appointment each year of graduate engineers to the position of civil engineer student. During the first year of their connection with the Office they are given a most thorough training in all branches of the work and in many cases are retained as junior highway engineers. The Office is in constant receipt of requests from States, counties, and townships to recommend suitable young engineers to take charge of road improvement. During the last year nine engineers, constituting a very considerable percentage of the total number, resigned to take up work in various parts of the country. While the operations of the Office are handicapped to a certain extent by this constant drain, the exact purposes of this course of instruction are thereby served in the highest degree. If a greater number can be appointed and trained each year, the result will in time have a very material bearing upon the progress of road improvement. While the object-lesson road is an excellent example, a capable, progressive engineer constitutes an infinitely greater force in the movement, as he should reasonably be expected to go on year after year adding in a material sense to the efficiency of our road systems. This project should receive greater financial support and the number of appointments should, if possible, be doubled or trebled.

PROGRESS OF ROAD IMPROVEMENT.

The Office is assembling reliable data as to the progress of road improvement in the United States and the relation of roads to agriculture. Through an organization composed of special agents in all parts of the country the Office will soon be in a position to receive

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prompt reports of progress along all lines. This information will be disseminated in such a way that the work in the various States can be so correlated and coordinated as to minimize the duplication which is now so much in evidence.

TESTING OF ROAD MATERIALS.

In the routine testing and examination of road materials great progress has been made along established lines. The total number of samples tested during the year was 1,168, an increase of 59 per cent over the number received and tested during the preceding year. In addition to these routine tests, investigations were made with a view to the utilization of slag and other by-products in road building, and these were extended to comprise field experiments through the construction of short sections of road at Youngstown, Ohio, and Ithaca, N. Y. These investigations have developed the fact that practically all the basic open-hearth slags are well adapted to road construction, especially when used as binding materials. It has been found that by adding quicklime to blast-furnace slag screenings the cementing properties are greatly increased. These investigations will be continued during the next fiscal year.

CULVERTS AND BRIDGES FOR HIGHWAYS.

The need for better culverts and bridges for our public highways is becoming evident, both from the point of view of economy and safety for the public. Information on this subject in suitable form has been in the past, and still remains, fragmentary and scattered.

By far the larger number of such structures that are needed are of the shorter spans—50 feet or less—and in the past they have been built of timber, which is, however, constantly increasing in price, and requires a relatively much larger expenditure for maintenance. Much economy can be effected, and more durable and safer structures can be built out of concrete or masonry, provided that the required information and skilled supervision may be had.

Owing to the fact that the individual pieces of work are small, those in responsible charge have not felt warranted in incurring the expense incident to the employment of skilled engineering assistants.

Such information as is referred to above is now being collected, and it is hoped that much of value will be in shape for publication and distribution during the coming fiscal year.

The published information will be supplemented by personal inspection and advice by engineers of the Office when request is made through the local authorities.

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INVESTIGATION OF DUST PREVENTIVES AND ROAD BINDERS.

During the past year the work of the Office relative to the investigation of the problems of dust prevention and road preservation has advanced rapidly.

Routine tests or analyses of bituminous road materials made in the laboratories during the past year were more than double the number made during the preceding year. A number of these examinations were made in conjunction with the experimental field work of the Office, and were reported, together with descriptions of the experiments, in Circular No. 92. It is expected that these examinations will be of great service in determining the value of certain classes of binders, as the experimental work is carefully inspected from time to time, and the results are made a matter of record.

Through its laboratory work, the Office has been able to offer valuable advice in regard to specifications for bituminous road binders, and in many instances to frame such specifications upon request of various public-service bodies. A number of the state highway commissions have profited by this opportunity.

Many worthless road preparations have been, and are at present being, manufactured and sold to the public through ignorance on the part of both producer and consumer with regard to the requisite characteristics of such materials to meet local conditions. These materials are sold under trade names and as a rule carry no valid guaranty of quality. Specifications for such materials are therefore much needed for the protection of the public, and this phase of the work will be given continued attention by the Office.

Special investigations of bituminous road materials carried on by the laboratory have covered improvements in the methods of analysis, the effect of various methods of distillation upon the physical and chemical properties of tars, and the development of a test for determining the binding value of bitumens.

CORROSION OF IRON AND STEEL.

The investigations carried on by the Office relative to the corrosion of iron and steel have induced some of the manufacturers to produce a practically pure iron for culverts and pipes. While it is not possible to produce an iron that will be entirely free from rust, yet it is believed that these pure grades of metal are going to give very much better service.

Investigations in regard to fence wire have shown that wire fencing is not only made of inferior material, but that in many cases the galvanizing is put on very thin. Some of the manufacturers have already improved their products in these respects as a result of this work.

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The corrosion experiments have been extended to the use of paints in the protection of structures of iron and steel, and as a result of these paint experiments the entire science of protective paints has been placed on a firmer foundation. It is now possible to design and specify a protective paint which will not only cover the metal, but will act as a rust inhibitor. It has been shown that the life of wire fencing can be prolonged by painting it, at an expense of about 1 cent per rod.

OIL-CEMENT CONCRETE.

The Office has conducted important investigative work during the past year in the development of oil-cement concrete. Portland-cement concrete is rapidly becoming a universal building material. The principal objection to the present use of cement concrete is that it is extremely porous and absorbs water. It has been found during the laboratory investigations that it is possible to mingle mineral oils with concrete while it is still wet and before it is laid or molded in the forms, so that the material may thus be rendered waterproof. Several pieces of road surface have already been improved by oil-cement concrete. In addition to this, a bridge surface has been constructed of this material in New Jersey. Up to the present time these surfaces are giving entire satisfaction. Oil-cement concrete is now being given a practical application on a series of new vaults at the United States Treasury. From the results already obtained, the experiments indicate that it would be practicable to use this material for floors, cellars, foundation walls, tanks, silos, manure pits, and similar construction, where strength, solidity, and waterproof qualities are required. Varying amounts of oil have been used in these experiments, the best results having been obtained when the amount of oil represents about 10 to 15 per cent of the weight of the cement used. The project is yet in an experimental stage and the results obtained should not be considered conclusive.

THE HANDLING OF PERISHABLE PRODUCTS.

It will be observed that more and more attention is being directed to the study of the handling of perishable products, that waste may be lowered and quality and condition improved. Such investigations as have been conducted in California on the handling of citrus fruits and table grapes; in Georgia on the handling of peaches; the handling of poultry and eggs, oysters, corn, wheat, flaxseed, milk, codfish, sweet ciders, etc., indicate the breadth of the work now in progress. The results already obtained show the great value and importance of such studies in the conservation of our finished products—the most valuable asset of any people.

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The foregoing is a brief account of what the Department has been doing during the past year to help farmers through research and demonstration. We have been diligent to contribute toward heavier crops, owing to high prices for the necessities of life, and we feel justified in thinking that our efforts and those of the scientists of the States are telling in the grand totals set forth. The day's work on the farm is accomplishing more, and the acre is yielding more. During the past year much attention has been given to demonstration in the field of what is known to advanced students, that men of limited means and circumscribed conditions might learn by object lesson better methods and thereby increase their incomes and also contribute to the magnitude of our crops.

Science that is not applied is dead.

The details of the operations of the Department will be found in the reports of the heads of the various Bureaus, Divisions, and Offices.

Respectfully submitted.

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C.,
November 23, 1910.

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REPORTS OF CHIEFS.

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REPORT OF THE CHIEF OF THE WEATHER BUREAU.

UNITED STATES DEPARTMENT OF AGRICULTURE,
CENTRAL OFFICE OF THE WEATHER BUREAU,
Washington, D. C., October 10, 1910.

SIR: I have the honor to submit a report of the operations of the Weather Bureau during the fiscal year ended June 30, 1910.

WILLIS L. MOORE,
Chief of Weather Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

MOUNT WEATHER RESEARCH OBSERVATORY.

Upon the completion of the new main observatory at Mount Weather, the necessary instrumental equipment for taking a full set of meteorological observations was immediately installed, and the first observation in the new building was made on February 18, 1910.

Two observations of the surface meteorological conditions are made daily and telegraphed to Washington, D. C. These observations form a part of the general groundwork upon which the daily forecasts of the weather are made.

AERIAL RESEARCH.

In addition to the observations of the surface conditions, there is also telegraphed to Washington each day a brief statement of the observations made in the free air at different heights above Mount Weather.

In the beginning of aerial research by the Weather Bureau, in 1897, it was conceived that a synoptic chart of upper-air conditions, made daily, if possible, would be a decided gain to meteorology. Therefore a network of 17 stations was equipped with kites as the sole means of sending recording instruments into the air. It soon developed that kite flights could be made only on days when there was sufficient wind, and that these formed a smaller percentage of the whole than was expected. For this and other reasons the plan of constructing a chart of upper-air conditions was abandoned.

In planning the upper-air work at Mount Weather, advantage was taken of this earlier experience, and an equipment was installed that promised to insure flights in almost any kind of weather. To a certain extent the equipment now on hand has fulfilled its promise. At times, however, the winds blow over the mountains at almost

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hurricane velocity, while at other times the mountain top will be shrouded by a covering of cloud and rain—conditions that baffle any attempt to launch a kite successfully. In the past twelve months there were nine occasions when a kite flight or a balloon ascension could not be made on account of stress of weather or because of other hindering conditions, such as lack of hydrogen gas in winter.

For the first few years flights at Mount Weather were made on week days and holidays, but not on Sundays. The omission of Sunday flights was largely because of the general rule of the institution to suspend activities on the seventh day in order that its employees might get needed rest and recreation. Following a different arrangement of the force and the addition of a storage battery, Sunday flights began on July 18, 1909, and have continued regularly since, except when prevented by adverse weather conditions.

Progress in the exploration of the upper air must of necessity be slow: First, the records obtained are not uniform, either as to the altitude attained or the time of day the ascension is made; second, owing to the varied character of weather conditions met with in the course of a year it is not possible to distribute the flights in such a way that a fair average of each set of conditions will be obtained. In fact, many important changes occur of which no record is possible. Fortunately, the number of days on which adverse weather conditions prevent a kite flight or balloon ascension are few, there having been, as before stated, but nine during the last year. But, on the other hand, there were 10 days on which the altitude attained was only 1,000 meters, or less, above sea level; 97 days when the altitude reached was between 1,000 and 2,000 meters;[a] 112 days when it was between 2,000 and 3,000 meters; 74 days with a record of between 3,000 and 4,000 meters; 45 days with 4,000 to 5,000 meters, and 16 days when a height of more than 5,000 meters was attained. Thus it will be seen that the material for study is composed of many flights up to between 3,000 and 4,000 meters and a much smaller number, about 17 per cent of the whole, above that height. It is obvious that a direct comparison of atmospheric conditions, one day with another, is not possible, except when daily records of approximately the same altitude are at hand.

Since the weather conditions, especially those in an area of low pressure, often preclude the sending up of a kite or captive balloon, and since only that portion of the atmosphere up to about 10,000 feet can be profitably investigated by their use, recourse must be had to free small rubber balloons for sending instruments to greater heights. The small balloons are filled with hydrogen gas, and may be sent up singly or in tandem. When sent up singly a parachute is attached so that when the balloon bursts the instrument will be brought safely to the ground. Sounding balloons, as they are called, were used in Europe as early as 1893. Their first use in this country was at St. Louis in 1904 by Rotch. Their first use simultaneously at two stations in this country was by the Mount Weather Research Observatory in September and October, 1909, at Fort Omaha, Nebr., and Indianapolis, Ind. The party at Fort Omaha obtained hydrogen gas from the Signal Corps plant at that place. The party at In-

[a] 1,000 meters=3,281 feet.

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dianapolis used hydrogen gas generated on the ground by the iron filings-sulphuric acid process, using a portable generator. As the gas thus generated did not have the lifting power of that used at Fort Omaha, two balloons instead of one were used at Indianapolis, which necessarily reduced the number of synchronous ascensions. Twelve of the 13 instruments sent up from Fort Omaha and 6 of the 7 sent up from Indianapolis were recovered.

The mean of the highest altitudes reached at Fort Omaha was 13.3 kilometers, or about 8.3 miles. The greatest altitude reached was a little over 24 kilometers (15 miles). The average height of the Indianapolis ascensions was 14.6 kilometers, about 9 miles, and the height of the highest individual ascension at that place was 19.4 kilometers, or about 12.5 miles.

The detailed data of pressure, temperature, moisture, and directions of the wind for all of the flights will be published in a report already prepared by Research Director W. R. Blair.

A sounding-balloon expedition to Fort Omaha was made by a party from the Mount Weather Research Observatory in May, 1910. Fifteen out of 20 instruments sent up on this expedition were recovered. The altitudes attained were not great, owing, apparently, to a poor quality of rubber in the balloons, which permitted the gas to escape.

Notwithstanding the difficulties encountered in aerial research, the work thus far carried on at Mount Weather has disclosed the following new and important facts:

The stratification of the lower portion of the atmosphere, as regards its temperature and moisture, is more extensive than was hitherto suspected. It has been known for many years that the temperature of the air diminished with increasing altitude, but the details remained more or less obscure until revealed by the daily records brought down by kites and balloons. It has been found that there are many exceptions to the rule of decrease of temperature with increase of altitude; thus, a great layer of warm air is sometimes found floating upon a layer of cold air; and furthermore the thickness and horizontal extent of such masses of warm air may vary greatly. Columns of warm air over a mile in vertical extent have been measured. Again, kite ascensions have disclosed temperature inversions of which no trace remained on the descent of the kite a few hours later. These evanescent inversions are probably produced by small masses of relatively warm air flowing across the line of ascent.

The kite flights have also thrown new light upon the direction and the depth of air currents from the surface to the highest altitudes attained. The various strata of air flowing past a place of observation are not of uniform depth and direction from the surface up, as might be supposed, but are at times composed of layers, each differing somewhat in direction from the next adjoining layer. The direction of the surface wind may be from the south, and at the same moment the direction a half mile upward may be from the southwest, and a half mile above that level it may be from the west.

It was known from observations of the clouds that in this hemisphere the wind was deflected to the right with increasing altitude above the ground, but the kite and balloon observations show that at times it is deflected to the left. It has also been found that the depth of easterly winds on this continent is less than over northern Europe.

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The data secured by means of kites and balloons point to another equally important conclusion with respect to the time that temperature changes occur at the surface and at altitudes between 1 and 2 miles above, viz, that the changes occur practically simultaneously at both levels. While this conclusion is probably not final, it is in strong contradiction to statements which have been made in this country to the effect that the temperature changes at relatively high levels foreshadow those which take place in low levels twenty-four hours afterward.

The temperature gradient—that is, the rate of decrease of temperature for each 100 meters of ascent—immediately before the so-called heat thunderstorms does not accord with that called for by theory. Likewise in heated terms, or the so-called "heat waves," the unusually high temperatures appear to be confined to the air strata next the earth's surface and up to less than half a mile above. The heat wave does not advance abruptly as a wall of high temperature, but rather builds gradually over the region affected.

ATMOSPHERIC ELECTRICITY.

During the year apparatus was installed by means of which the potential gradient on the kite wire could be read off conveniently. This work, however, should be considered as merely preliminary to a more complete determination of the ionic content and movement in the free air.

No change has been made in the magnetic work during the year. Photographic registers of the declination, the inclination, and the horizontal intensity are made daily, and the photographic sheets are properly checked so that hourly values may be drawn therefrom hereafter.

SOLAR RADIATION.

Measurements of the intensity of solar radiation and the percentage of polarization of sky light have been made at Washington and Mount Weather, as in previous years. A five-year series of observations at Washington was completed on April 30, 1910, and the results have been summarized for publication in the Mount Weather Observatory Bulletin.

In addition to computations of the value of the solar constant, which are necessarily confined to observations obtained on days when the sky is exceptionally clear, all the pyrheliometric measurements made during the five-year period, 7,350 in number, have been utilized in determining the mean rate at which solar radiation is received at Washington, D. C., with a cloudless sky for different angles of the sun and with average solar declination for each month.

These monthly and annual mean rates show greater departures from the normal than do the computed values of the solar constant. The pyrheliometric observations obtained at European observatories during the past twenty-six years also show marked fluctuations. It therefore appears to be desirable to undertake a systematic study of the rate at which solar radiation is received at different points in the United States, and of the variations that occur in this rate from year to year. For this purpose, pyrheliometric records as nearly complete as possible will be obtained at four or five stations, so located as to be fairly

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representative of the different climatological sections of the United States. Prof. H. H. Kimball will have charge of the carrying on of these observations, mostly at points west of the Mississippi River, during the coming fiscal year. Preparations are practically completed for equipping these stations with the new form of pyrheliometer developed and partly constructed by Prof. C. F. Marvin. It is hoped to supplement this instrument in the near future with one that records continuously.

THE VAPOR IN THE ATMOSPHERE.

Progress has been made toward the installation of apparatus, especially optical, adapted to the study of the quantity of the water vapor in the atmosphere and the investigation of the radiation and absorption of materials and their varying surfaces.

The amount of water vapor in the atmosphere is of such importance as to justify attempts by all known methods to determine it. At present only the hair hygrometer and the spectroscope are available for measurements in the atmosphere above the surface of the earth, and while both methods are unsatisfactory, they should be used for such results as they can give. The amount of water vapor in the air next to the earth's surface is so strongly affected by purely local conditions that its use in weather forecasting has long since been abandoned.

The spectroscopic observations will be made by Prof. William J. Humphreys.

DISCUSSION AND PUBLICATION OF DATA.

In meteorology, as also in most other natural sciences, the accumulation of data and their discussion from a physical standpoint must go hand in hand; in other words, it would not be wise to go on accumulating data without an attempt at interpretation. To provide a means of publishing the data obtained at the Mount Weather Research Observatory a regular publication, known as the bulletin of that observatory, was established in 1908, as noted in former annual reports. On account of his experience and success as editor of the Monthly Weather Review, Prof. Cleveland Abbe has been assigned as editor of the bulletin.

The field of the new bulletin is technical meteorology and not climatology or education. During the year six numbers have appeared, completing Volume II and including the first part of Volume III. The bulletin contains the detailed records brought down by kites or balloons up to about 5,000 meters in the atmosphere. The results of the first series of synchronous sounding-balloon records made in this country will appear in part 2 of Volume III.

During the year articles discussing the theoretical as well as the practical application of the data obtained at Mount Weather and elsewhere to the problems of meteorology have appeared in the bulletin. The articles on aerial work have been contributed by Research Director Blair; those on the quantity of heat received from the sun by Prof. H. H. Kimball; and those on the changes of wind with altitude by Prof. A. J. Henry, who has also served as executive officer of the observatory.

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While the bulletin is devoted principally to the work of Weather Bureau officials at the observatory, its columns are open to eminent scientists throughout the world. Among the latter who have contributed during the year are Prof. R. S. Woodward, president of the Carnegie Institution of Washington; Prof. A. Lawrence Rotch, director of the Blue Hill Observatory; E. Gold, of the meteorological office of London; and Prof. J. H. Jeans, of Princeton University.

FORECASTS AND WARNINGS.

UPPER-AIR OBSERVATIONS AS AIDS TO FORECASTING.

The daily telegraphic reports of upper-air observations from Mount Weather, Va., have been of aid to the forecaster at Washington during the past year, and it is believed that their continued use will further increase the accuracy and range of the forecasts. The following are concrete examples of possibilities in this way:

In this section a storm center sometimes passes eastward or northeastward over the ocean, without being followed by clearing weather on the coast States, as would ordinarily be expected, because of a secondary storm development off the middle or south Atlantic coast. A study of the Mount Weather kite flights shows that north winds occur at high altitudes in advance of the formation of a storm of this character. Thus, it is hoped to be able in future to forecast their development, and thereby increase the accuracy of the forecasts of the weather that follows for the entire coast district.

Again, it has been found that when a low-pressure area is approaching from the southwest, and the winds turn to the right (clockwise) with ascent, the usual warming up in the Atlantic States seems to be retarded about twenty-four hours.

Also, the turning of the winds to the left (counter-clockwise) with increased altitude shows the depth of the cold northwest wind. From this may be drawn reasonably correct inferences as to the fall in temperature that may be expected at the surface of the ground within the next twenty-four hours.

The thickness of the stratum of cold air that advances from the west or northwest with the approach of an anticyclonic area is of the highest importance in determining subsequent temperature conditions. The temperature reports for high altitudes show whether the stratum is shallow or of great depth. When shallow, the cold weather accompanying the high is neither severe nor of long duration; but if the blanket is thick and abnormally low temperatures are reported aloft, the cold will be of marked intensity and will probably last several days. In predictions of sleet, also, it is essential to know what is going on in the upper air. Conditions favorable for sleet are comparatively warm upper air and a thin layer of lower air with its temperature somewhat below the freezing point.

HURRICANES OF THE YEAR.

The hurricane season of the past year was marked by a number of severe tropical disturbances. Warnings were given to shipping and other interests in every instance in time for them to take all necessary precautions.

The Galveston hurricane of July 21, 1909.—The storm was first observed in the Caribbean Sea to the southeast and then to the south

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of Jamaica on the 15th and 16th. The center of the disturbance moved northward over the Yucatan Channel into the Gulf of Mexico from the 17th to 19th, thence northwestward with increasing energy during the 20th, reaching the Texas coast just south of Galveston on the 21st. Beginning on the 17th, advices regarding the storm were telegraphed to Havana and southern Florida ports, and from the 18th to 21st Atlantic and Gulf shipping interests were informed daily regarding its probable position and course.

The following is from the report of the official in charge of the Weather Bureau office at Galveston:

The first announcement of the storm's approach was received at this office on the 18th. Advisory messages followed on the 19th and 20th, that of the 20th being to the effect that the disturbance was over the central Gulf, moving northward. Shipping interests and the public were kept thoroughly informed by telephone, bulletins, and the press, and I believe that on July 20 there was not a single news-reading person in the city who was not aware of the storm. It is estimated that the Gulf rose 10 feet above the normal. Volumes of water dashed over the sea wall and flooded the lower portions of the city.

Extract from the Post, Washington, D. C.:

The citizens of Galveston and the residents of the Texas coastal plain owe a debt of gratitude to the United States Weather Bureau for the timely warnings of the tropical storm that recently swept in from the Gulf of Mexico. While the loss was not large from the ravages of the hurricane, yet it probably would have reached an appalling total in death and damage to property had not the storm's destructive path been foreseen by the Bureau many hours before it struck the coast.

Extract from an Associated Press report from Houston, Tex.:

Advices show that damage was done throughout a section of Texas extending on an average 100 miles into the interior. In some counties reports indicate that very few home owners escaped losses of at least a minor sort. While the property destruction has been great, the life loss and serious injury is inexplicably small. This is attributed largely to the fact that storm warnings gave the inhabitants an opportunity to prepare for the expected blow.

Hurricane of August 27, 1909.—This storm, which caused great loss of property at Mole St. Nicholas, was first observed south of Haiti on the 23d. Advices issued on that date stated that the disturbance would move west-northwestward in the region of the Bahamas, and that rough weather would be experienced in Cuban waters, and probably as far south as Jamaica. On the 24th the southern provinces of Cuba were visited by heavy winds and rains that caused considerable damage to property, and in the afternoon a wind velocity of 60 miles an hour from the northeast was reported from Havana. On that date advices were issued that the storm would move west-northwest toward the southeastern portion of the Gulf of Mexico, and vessels were cautioned to avoid those waters. On the 26th the steamer *Cartago* reported the storm by wireless to New Orleans, via Burwood, La., the distance from the ship to the receiving station being about 500 miles. This is the first instance in which a report of an encounter with a storm at sea was transmitted in time to be utilized in current forecast work. The storm struck the coast near the mouth of the Rio Grande on the 27th. Although it was severe, no lives were lost during its passage, due to the fact that the Weather Bureau warnings were timely and enabled the people living on the low islands along the Gulf to reach places of safety.

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Extract from the Corpus Christi Herald of August 30, 1909:

The people who were at Tarpon Beach are loud in their praises of the United States Weather Bureau, and say that had it not been for the warnings sent out by the Bureau every one of them might have been drowned. As it was, they received the warnings in time to seek safety in the quarantine station, where they all remained until the storm was over.

Tropical storm of September 17-21, 1909.—This storm was first observed south of Jamaica on the 14th. It moved thence northwestward to the Yucatan Channel, where it was central on the morning of the 17th. Advices were issued to shipping interests at Atlantic and Gulf ports that the hurricane center would probably move northward over the Gulf of Mexico; vessels in extreme south Atlantic and Gulf ports were warned not to leave their harbors, while vessels elsewhere preparing to sail to those waters were told to await the passage of the storm. After a northwestward movement the storm struck the Louisiana coast, about 50 miles west of New Orleans, on the 21st.

The following is taken from the New Orleans Picayune of September 22, 1909:

It must be said to the credit of the Weather Bureau that the excellent work done has proved of incalculable benefit to life and property by the issuance of timely warnings of the storm. On Wednesday of last week the Weather Bureau began to give out bulletins as to the location of the tropical hurricane and its probable trend, and this warning note never ceased from day to day until the crucial moment, Monday morning, when the definite warning was issued telling about the very near approach of the disturbance threatening south Louisiana and probably having some sinister design upon the city of New Orleans. The storm reached this city about the time forecast by the Weather Bureau, and it lasted until nearly midnight Monday.

The following is from the same paper, under date of September 25:

The admirable arrangements made by the weather service insures ample warning of the approach of these West Indian storms, but there is little that can be done to protect property from their ravages. That the timely warnings saved many lives is, however, undoubted, and were the people who live in exposed stretches of the coast to pay greater attention to these warnings the loss of life would be still more reduced. Sailors who go to sea carefully note the weather predictions and are guided thereby, whereas the people living on the low-lying coast, who have actually more to fear than the sailors, usually pay less heed to the storm predictions.

The Key West hurricane of October 11, 1909.—This storm was first noted over the south-central Caribbean Sea on the 2d, and masters of vessels in or bound for southern waters were kept advised daily, beginning on the 6th. On the 10th storm warnings were ordered on the south Florida coast, and at 6 a. m. of the 11th they were changed to hurricane warnings. After passing over Key West the hurricane swept the Florida peninsula south of Miami. On the extension of the Florida East Coast Railroad about 3,000 workmen were withdrawn from dangerous points as a result of the Bureau's warnings. The following particulars are taken from the report of the Weather Bureau official at Jacksonville, Fla.:

The correctness of the warning and the effectiveness of its distribution are indicated in the small loss of life—about a dozen—along the lines of the projected railroad. Those who were drowned paid the penalty of remaining aboard a tugboat, which sank, instead of seeking shelter, as did others. With about 3,000 laborers scattered for many miles over the low islands of the sea along the proposed route of the Florida East Coast Railroad, the fact that the loss of life was so small is an eloquent tribute to the wisdom of the railroad officials in obeying implicitly the information given out by the Weather Bureau. In

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1906 many hundreds of laborers were drowned during a tropical storm as a consequence of ignoring warnings. While many tugboats, lighters, and other auxiliary equipment were saved, the losses of the railroad company will reach hundreds of thousands of dollars. It is conceded by the company and by the public press that hundreds of lives were saved through the warnings issued in connection with this storm.

The cooperation of steamship lines has been requested during the coming year as an aid to the forecaster in predicting the direction of movement and the intensity of hurricanes in the Gulf of Mexico, the Caribbean Sea, and West Indian waters. It is hoped to have vessels in those waters report by wireless telegraph to the central office at Washington during the hurricane season of 1910 whenever the meteorological conditions are such as to indicate the presence of a hurricane in the immediate region of the reporting vessel. These reports, in connection with those received from special meteorological stations maintained by the Bureau in the West Indies, will give the forecaster information of the greatest value.

FORECASTS FOR EXTENDED PERIODS.

During the past year forecasts for a week or ten days in advance have been issued from time to time when certain well-defined weather types were shown by reports from selected stations throughout the Northern Hemisphere. These reports are charted daily and show the changes constantly occurring in the great centers of action that control the movements of storms over North America, and as a consequence determine its weather and climate. The conditions existing over western Europe, as shown by the Northern Hemisphere chart of January 26, are typical of the weather over that region during the latter part of January, when heavy rains and resulting floods were experienced in western Europe, and were of particular severity in France. During this period barometric pressure was abnormally low over Iceland and adjacent European districts, and the west-central and northwestern portions of Europe were almost constantly covered by the rain quadrants of a rapid succession of cyclonic areas of exceptional magnitude. These rains were of unprecedented duration and of excessive amounts. It is evident therefore that the floods were caused, not by deforestation, but wholly by the excessive and long-continued rains, extending with hardly any interruption over a period of several weeks.

During the early part of August, 1909, there was a decided lack of rain in the corn-growing States of the Mississippi and Ohio valleys, and in the upper Mississippi Valley the drought had become severe. Rain was also needed in the Middle Atlantic and New England States. On the 10th an announcement was made that the rains over the western portions of the cotton belt during the preceding two or three days would be supplemented during the succeeding several days by abundant rains in that section and generally over the Southern States. The rains set in as anticipated on the 12th and continued through the 13th.

The following special forecast was issued Wednesday, August 11:

Present barometric conditions indicate that the prevailing drought in the Atlantic States from Virginia northward over Maryland, Pennsylvania, New York, and the New England States will be relieved in part by showers by the close of the present week, and that more general rains will fall in the States referred to by the middle of next week.

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A period of rainy weather that set in over the Middle Atlantic and New England States during the closing days of the week ending August 14 continued until the middle of the following week, and in areas in those districts the rainfall was excessive.

On January 30, 1910, the following special forecast was issued:

Present barometric conditions over the Northern Hemisphere indicate that during the week beginning Monday, January 31, temperature will be moderate for the season generally over the United States until the close of the week, when a cold wave is likely to appear in the extreme northwest and advance thence to the Atlantic coast by the early portion of next week. In the meantime storms that will reach the Atlantic seaboard about the middle and close of the week will be attended by sharp fluctuations in temperature in Middle Eastern and Northeastern States and by precipitation generally east of the Mississippi. In middle and northern districts the precipitation will be in the form of snow. In the Missouri and western Mississippi valleys and the Plains States precipitation will be comparatively light.

A storm advanced from the Rockies to the Atlantic coast from February 1 to 3, and was attended by precipitation east of the Mississippi and by heavy snow in northern portions of New York and New England. In the Missouri and middle and upper Mississippi valleys the week closed with a cold wave that advanced thence eastward over the Atlantic States during the 6th and 7th, attended in portions of the Middle Atlantic States by the lowest temperatures of the winter. A notable feature of this cold wave was the extremely low temperatures noted in the kite flights at Mount Weather, where, at an elevation above the station of 6,700 feet, a reading of 26° below zero was recorded on the morning of February 7. At the station the temperature at the same hour was 14° above zero.

On February 6 the following special forecast was issued:

The week beginning Monday, February 7, will open with temperature considerably below the average for the season over the eastern portion of the United States. Following the cold period in the East, temperature will rise slowly during the next several days. A disturbance that will reach the Atlantic coast from the Middle West and Northwest about Thursday will be attended by precipitation from the Mississippi Valley eastward; that in more northern States will be in the form of snow and will be followed by a change to colder.

The center of this disturbance reached the Atlantic coast Thursday morning. Its advance from the Rockies was attended by rain in the Southern and Middle States east of the Mississippi and by snow from the Lake region over New York and New England. It was followed by a marked fall in temperature and by freezing weather as far south as the middle Gulf coast.

On Sunday, February 13, the following special forecast was sent out:

During the present week a general storm, followed by a cold wave, will cross the United States. The center of this storm will appear over the Pacific States within the next two days, cross the Rockies, Plains States, and central valleys during the middle days of the week, and reach the Atlantic seaboard by Friday. The cold wave promises to be rather severe. It will overspread the North Pacific States by Tuesday morning, the middle and northern plateau and Rocky Mountain districts by Wednesday morning, the middle and northern Plains States and central valleys by Thursday, and reach the Atlantic seaboard by Friday or Friday night. In the event of warm heavy rains in the near future, the extraordinary depth of snow on the ground in parts of the Lake region and in the mountain districts of the Middle Atlantic and New England States will present conditions favorable for freshets and floods in the streams of those regions. The outlook for the present is that a tendency toward flood conditions in the larger streams about the middle of the week will be checked by cold weather that will arrive later in the week.

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The storm referred to appeared over the North Pacific States on the 14th and moved thence southeastward to the West Gulf States, where it recurved eastward and northeastward and passed to the New England coast by Friday morning, the 18th. It was attended by heavy snow from the Middle Mississippi Valley over the Ohio Valley and lower Lakes, by rain or snow in the Atlantic and West Gulf States, and by rains and thunderstorms in the East Gulf and South Atlantic States. Its passage over the Gulf and Atlantic States was attended by gales of unusual strength. The storm was followed by a cold wave that carried the line of freezing temperature to the Gulf coast.

The following editorial regarding the cold wave and storm above mentioned is taken from the Oklahoma Oklahoman of February 17:

The remarkable accuracy with which the blizzard that is now traveling across the country was predicted days in advance of its advent is deserving of most favorable comment. Sunday's newspapers throughout the United States carried a warning from the Weather Bureau to the effect that a storm was approaching the Pacific coast that would traverse the entire continent and reach the Atlantic coast by Friday. In Oklahoma marked derangement of atmospheric conditions was noticeable Monday night. Late Tuesday evening there came a sudden drop in temperature accompanied by high winds. By Wednesday morning the mercury had dropped to 10° above, and the boreal blasts were carrying considerable snow. Thus the story of a prediction and its fulfillment. The advance warning should have been of incalculable benefit to live stock men and to shippers and others engaged in vocations which are affected by meteorological conditions.

In the latter part of March, 1910, it was thought that sufficient advance had been made in the knowledge of general weather types to permit the issue each Sunday of a forecast for the ensuing week. Since that time weekly forecasts for the United States, together with a general résumé of weather conditions throughout the entire Northern Hemisphere, have been issued with gratifying success.

The following is a copy of the first regular weekly forecast:

The vernal equinox inaugurates the rainy season in the Tropics. The autumnal equinox marks the central period of the season of so-called equinoctial storms. When the sun in its annual northward journey crosses the line of the equator the rainy season sets in over the northern equatorial region, and the rain belt keeps pace with the northward movement of the sun until the period of the summer solstice, June 22. About that time the rain belt reaches the northern subtropical regions, like Florida, and the rainy season begins in those regions. Attending the southward movement of the sun, the rain belt again crosses the Tropics, and when the sun has about half completed its return course to the equator the season of severe tropical or equinoctial storms begins in the tropical and subtropical regions of the Atlantic. The North Atlantic season of equinoctial storms extends from August to October, inclusive. On the Atlantic Ocean these storms are called hurricanes, on the Indian Ocean cyclones, and in southeastern Asiatic waters typhoons. In the Pacific area the typhoon season begins earlier and continues later than the hurricane season of the North Atlantic. The vernal equinoctial period of the present year has been attended by exceptionally fine weather over the American continent east of the Rocky Mountains and in western Europe and adjacent waters. Along and south of the transatlantic steamer tracks light to moderate winds and smooth seas have prevailed. Over middle and southern latitudes of the Pacific and adjacent Asiatic coasts no severe disturbances have been reported. Over western portions of the American continent and in eastern Europe and the interior Siberian area marked barometric changes have produced unsettled and stormy weather.

During the present week temperature in the United States will average mild for the season. A disturbance that now occupies the California coast will move eastward and reach the Atlantic coast about Friday. Another disturbance is indicated that should cross the country from about March 31 to April 4. The

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disturbance should be attended by rains of increasing area, and will be followed by changes to cooler weather. Atmospheric movements will be more active along the transatlantic routes, and a period of rains is indicated for the British Isles and northwestern Europe.

The following is an extract from a weekly bulletin issued June 12, 1910:

At the close of last week a pronounced disturbance appeared over Iceland, whence it will move eastward and give stormy weather over the British Isles and northwestern Europe during the next three or four days.

The extract next following is taken from the résumé of the following week, and shows the accuracy of the prediction above quoted:

A disturbance of marked intensity moved southeastwardly from Iceland over Europe during the first half of the week, attended by general rains, which produced floods in the rivers of north and central Europe.

The following special forecast was issued Wednesday, June 22:

As forecast in the special bulletin of Sunday, the 19th instant, a break in the hot wave that has prevailed during the past week in Montana, North Dakota, South Dakota, Nebraska, and western Minnesota is now in progress, and the indications are that there will be local rains and several days of normal temperature in those States. Warm weather is forecast to continue in the southern Plains States, the Mississippi Valley, and the eastern districts during the next several days.

The feature of the weather for the week ending June 25 was the hot wave in the Northwestern States during the first half of the week and in the Eastern States from Monday until Friday. Temperatures near or above the highest previously recorded in the month of June occurred Monday and Tuesday in Minnesota, North Dakota, South Dakota, Nebraska, and eastern Montana. Local rains occurred the latter half of the week in the Rocky Mountain region, the Plains States, and the upper Mississippi Valley.

ADDITIONAL ALASKAN REPORTS.

Reports from three additional stations in Alaska during the year have materially aided in the preparation of the weekly forecasts. It is gratifying to learn that the Canadian Meteorological Service will shortly establish two new stations, one at Cochrane and the other at The Pas, thus extending the range of observations northward and enabling the forecaster to predict more accurately the sweep of cold waves and storms from that region.

RIVER AND FLOOD DIVISION.

The administrative work of the River and Flood Division was of the usual description, having been largely devoted to improving the character of the personnel and securing increased efficiency and permanency of equipment. A number of special observers were separated from the service on account of incompetency and neglect of duty, and river gauges were repaired or renewed where necessary. As a rule the spring floods damage or destroy many gauges, necessitating a large outlay for renewals, but during the past spring the absence of severe floods permitted the application of a reasonable amount of money to the work of improvement. During the year a Marvin automatic gauge was successfully installed at Parkersburg, W. Va., and it is proposed to install similar gauges during the coming year

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at Des Moines, Iowa, and Sacramento, Cal., if the work of constructing the new bridges at those places shall have advanced sufficiently. A new river gauge of the inclined concrete type was installed at Henderson, Ky., and contracts have been let for similar gauges at Portsmouth, Ohio, and Mount Vernon, Ind. While the original cost of these concrete gauges is considerable, it has been found that their permanency insures a profitable investment.

The uniform success that has attended the forecasting of the disastrous floods that occur at times in the Grand River of Michigan has led to the extension of the river service to the watershed of the Saginaw River in the same State, and it is thought that after the accumulation of some comparative data equally efficient service can be afforded in that section. The river district of Hannibal, Mo., was created during the year by assigning to it that portion of the St. Louis district lying between Hannibal and the mouth of the Des Moines River, and other changes of a minor character were made.

The great floods of the year were those of July in the Missouri River and its tributaries east of Kansas City and in the Mississippi River from Hannibal, Mo., to Chester, Ill.; that of November and December in the North Pacific States; and that of January in Utah and southern California, the last named being one of those rare occurrences known as a "desert flood." The floods of July overflowed about 1,000,000 acres of farm lands, of which two-thirds were under cultivation, with resulting loss of about $7,000,000, of which amount $5,500,000 were in crops. Along the Grand River of Missouri the flood was particularly severe, and the stages of water were the highest of record. The warnings issued by the Weather Bureau during this flood saved property to the value of $1,000,000 that otherwise would have been lost. The north Pacific floods of late November and early December were in the main mountain floods, caused by continuous warm heavy rains and rapidly melting snows, and did damage to the amount of about $4,000,000. As it is not possible to maintain effective flood service along mountain streams, no specific warnings of these floods were possible, but general warnings were issued as soon as the conditions became threatening. The "desert flood" of January was caused by warm rains falling upon the heavy December snows, and the actual losses totaled at least $3,000,000, falling most heavily upon the railroads.

The spring flood in the Ohio River did not assume dangerous proportions, although in January the Wolf Creek ice gorge for a time created a very alarming situation below Louisville.

The daily forecasts for the navigable rivers are still an indispensable adjunct to the successful conduct of river steamboating.

The accuracy and timeliness of the river forecasts and warnings attained during previous years have been maintained, and there is reason for the belief that during the year just ended the groundwork was laid for still further improvement. The comments of the press and interested parties relative to the conduct of the work were uniformly commendatory, and their reproduction here would be but a repetition of those of former years.

The study of the Ohio River was continued, and forecast schemes were completed for the entire river, except for the section from Mount Vernon, Ind., to Cairo, Ill. The schemes for the Cumberland and Tennessee rivers are well under way, and hopes are entertained that

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the entire scheme for the Ohio watershed will be completed during the coming year.

There is still need of some further extension in the line of direct flood work, notably in Oklahoma, Indiana, and Illinois, and along some of the upper tributaries of the Mississippi River, but little can be accomplished during the next fiscal year, as projects already under way will consume any funds that might otherwise have been available.

Over a year ago it was recognized that the approaching completion of the irrigation projects in the Far West by the Reclamation Service imposed new responsibilities upon the Weather Bureau, namely, the obtaining of accurate snow measurements at the sources of water supply, the determination of the water equivalent of the accumulated snows of winter, and the gauging of the streams for the benefit of the water users; and it has become a part of the duty of the River and Flood Division to determine as nearly as possible the amount of water that will be available each season for irrigating purposes. A sufficient supply of funds for the entire project has not yet been provided, but it has been proposed to conduct during the coming year at least one series of observations, probably in northern Utah, along certain definite lines. From the experience thus obtained it will be possible to pass intelligently upon the feasibility of the general plan and to prepare reasonable estimates of the annual cost of the entire project for submission to Congress. For a time, at least, this work must be limited to the smaller watersheds.

EFFECTS OF FOREST ON CLIMATE AND STREAM FLOW.

There remains one other problem that will engage the special attention of the River and Flood Division. The widespread discussion during the last two or three years as to the effect of forest cover on climate, stream flow, etc., has developed such differences of opinion in the minds of those chiefly interested as to necessitate a searching inquiry into the subject. After an elaborate research into all available data, the Weather Bureau, in company with many eminent engineers, concludes that on the principal rivers the floods are not higher or longer continued or the low water lower than forty years ago, while other persons hold to the opposite. But there are other questions with regard to which all appear to agree that available data are at best insufficient; consequently, to quote from my report of February, 1910, to the Committee on Agriculture of the House of Representatives on "The influence of forests on climate and on floods:"

> We must therefore reason empirically from the best information at hand, and this insufficiency of data renders less positive the conclusions of all investigators, no matter which side of the question they may be on.

Therefore the Weather Bureau and the Forest Service, with the permission of the Secretary of Agriculture, have agreed to cooperate in an exhaustive study of the entire question of forest effects upon climate and stream flow, and have selected as a suitable field for operation the Rio Grande National Forest, in southwestern Colorado. Representatives of the Weather Bureau and the Forest Service are already in the field making preliminary arrangements, and active work will begin as soon as the Weather Bureau can supply and install the necessary equipment and the Forest Service can provide the necessary

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facilities. It is hoped to have the work well under way by August or September, 1910. Two watersheds of similar topography and of limited drainage areas have been selected, and the necessary weirs and instruments for the measurement of stream flow will be located at an approximate altitude of 9,500 feet above mean sea level, the drainage area extending upward to an elevation of about 10,500 feet.

It is proposed to measure the flow of the two streams for a sufficient period, probably eight or ten years, to demonstrate their behavior with equal forest cover. One of the watersheds will then be denuded and streamflow measurements continued on both for another period of eight or ten years, by which time it is probable that the effects of the denudation, whatever they may be, can be stated in positive terms. In order that all the climatic factors that affect or modify stream flow may be considered, a complete equipment of meteorological instruments will be provided and observations will be taken several times daily. Automatic instruments will afford continuous and permanent records of pressure, temperature, wind direction and velocity, sunshine, precipitation, and evaporation.

The proposed period of observations is none too long, and in view of the possible influence of the investigation upon certain questions of public policy, and in the interests of scientific research, it may become necessary later on to extend it.

INSTRUMENT DIVISION.

About 200 stations of the Bureau are now fully equipped with recording instruments, 3,000 cooperative observers are supplied with maximum and minimum thermometers, rain gauges, and instrument shelters, and about 150 stations are provided with steel towers and high-power oil or electric lanterns for the display of storm warnings.

The new stations at St. Joseph, Mo., and Lansing, Mich., at which Weather Bureau buildings have recently been erected, were fully equipped with standard sets of instruments during the year. The regular station at Brawley, Cal., maintained in connection with the observations on evaporation at the "Salton Sea," was closed in May, 1910, and the equipment transferred to the special station at Wagon Wheel Gap, Colo.

The kiosks installed a year ago in some of the large cities have proved very popular, and more requests for these structures have been received than it has been possible to grant. Six kiosks were purchased during the year; three have been erected at prominent points in Hartford, Duluth, and Richmond, but the work of installation at Indianapolis, Salt Lake City, and Atlanta is not yet completed.

NEW WORK AND APPARATUS.

During the year Professor Marvin perfected certain new methods of measuring the intensity of solar radiation in absolute units of heat by the use of the electrical resistance thermometer. So far as known, this method has never been employed heretofore. It seems to possess great advantages over customary forms of the pyrheliometer, owing especially to the fact that the thermal capacity of the apparatus can easily be determined from time to time in the ordinary course of

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observation. Such a check is quite impossible with ordinary instruments. The first working apparatus of the new type has been turned over to Professor Kimball and is being installed at Madison, Wis. Additional instruments are under construction for a few other stations where observations of solar radiation are particularly desired.

Last October the Weather Bureau was requested to pass upon a proposed simple plan of renewing and improving the protection of the White House from lightning. Professor Marvin submitted a revised plan, prepared in accordance with the best modern ideas and practice, which elicited the special commendation of the engineer of public buildings and grounds having charge of the execution of the work.

A special form of inverted, astatic pendulum, devised and installed by Professor Marvin in 1907, has since recorded earthquakes at the Weather Bureau in a very satisfactory manner. During the past year detailed drawings of an instrument of this type, adapted to record very destructive earthquakes, and having a possible maximum double amplitude of motion of 3 inches, was supplied to Prof. A. C. Lawson, of the University of California. The instrument is being made up at the shops of the university and will be installed in the special earthquake-proof vault provided for its new seismological equipment.

IMPORTANCE OF SEISMOLOGICAL OBSERVATIONS.

It seems appropriate at this point to renew the recommendations made in previous years that the Weather Bureau be authorized to engage systematically in making seismological observations and publishing the results. People in general, and scientists especially, have become fully aroused to the great importance of this work, and it is now well known that, when full information is available, definite advice can be given as to where to locate and how to erect buildings so as to minimize or even entirely escape disastrous effects of earthquake disturbances. Repeated appeals have been made to Congress to authorize and provide for seismological work, but thus far without avail. The United States is now the only important nation in the world in which seismological studies are not being carried on under the auspices of the Government. This work requires an extensive system of outlying stations from which reports can be procured, and at a limited number of which seismographs can be installed and maintained. The Weather Bureau is the only branch of the Government already having numerous stations widely distributed over the country and maintaining a corps of highly trained observers on duty at all times. It also has a corps of about 4,000 cooperative observers whose services are available for simple reports of earthquake phenomena, such as can be procured without instrumental equipment. By reason of this extensive and fully organized service the Bureau is peculiarly prepared to conduct seismological work in an effective manner, and at far less expense than would be possible through any of the other departments of the Government.

This was fully recognized by the seismological committee of the American Association for the Advancement of Science at a meeting held in Washington April 19, 1907, when it was definitely voted that the Federal Government should be then requested to support

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seismological work, and that appropriations therefor should be made through the Weather Bureau. This action of the committee was not only unanimous, but was heartily concurred in by the heads of all Government bureaus either directly or indirectly interested in the questions involved.

CLIMATOLOGICAL DIVISION.

The issue of the Monthly Weather Review in its new form, begun July, 1909, was considerably delayed during the first part of the year, but has since been brought practically up to date. The publication of the National Weather Bulletin was continued as in past years, weekly during the crop-growing season and monthly at other times. Weekly summaries of the snow and ice conditions were issued regularly during the winter, as were also the snowfall bulletins from the mountain States of the West. The latter have been considerably enlarged, owing to the extension of the special snowfall stations into regions not heretofore covered by reports. A special effort will be made in March and April to give the public an idea of the amount and condition of the snow actually lying on the mountains just before warm weather sets it flowing into the streams. Weekly and monthly summaries of climatological data continue to be issued at the Iowa, Porto Rico, and Hawaii centers, as in the past, but the publication of these summaries for the remaining sections was discontinued with the issues for June, 1909.

The current work of preparing data for the Monthly Weather Review and the Annual Report of the Chief of Bureau, the tabulation of the usual data into the permanent records of the Bureau, and the preparation of matter called for by numerous correspondents desiring information regarding the climate in various portions of the country, have been carried forward as usual.

The numerous requests for climatic data show an increasing knowledge of the information available for the public, and indicate the wide diversity of uses to which it is being put. Nearly 4,000 such requests received prompt attention during the year.

No material change has occurred in the cooperative work carried on by the Bureau. Cooperation with other bureaus of the Department and with the Geological Survey and Reclamation Service, in the gathering of information regarding the snowfall in the mountain regions of the West and the study of special problems in forestry and plant growth, has continued with apparently satisfactory results to all concerned.

The changes in the form of some of the current climatological publications of the Weather Bureau were made during the year in order to accommodate more fully than heretofore the requirements both of the public and of the General Government in developing the water resources of the United States, especially in connection with irrigation and transportation enterprises, as well as the many other public interests which have hitherto been served by these publications. Accordingly the material of which the Monthly Weather Review was formerly composed has been separated into two general parts: Technical articles on research problems in meteorology appear in the Mount Weather Quarterly Bulletin, while the more practical papers on engineering and commercial interests are still published in the Monthly Weather Review. Similarly, the data formerly pub-

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lished in the monthly section summaries are now arranged with reference to 12 climatological districts, conforming to the natural watersheds of the United States, and a district editor appointed to each district supervises the preparation of the material, which is finally assembled and printed in the Monthly Weather Review.

The Review in its present form is a strictly climatological journal. It contains, in addition to the current climatological history, occasional important papers on the relation of climate to agriculture, irrigation, transportation, and evaporation, the effects of forests on climate, and other similar contributions, but they are presented in a nontechnical manner as far as possible.

The plan of preparing and publishing climatological summaries, giving in some detail the vast amount of material that the Weather Bureau has been for many years collecting, has continued during the year. The entire United States will eventually be covered in these reports, which will be made up for 106 districts in all. Their publication is advancing rapidly and with the completion of the series, which will soon be accomplished, the public will have in form for ready reference the longer records of climatological data for all parts of the country.

MEASUREMENTS OF SNOWFALL.

Since the water used during the summer for irrigation in those western districts where irrigation is practiced depends largely upon the snowfall on the mountains of that region, the importance of measuring the snowfall in remote places which are inaccessible during the winter has made it necessary to discover some means of automatically measuring the seasonal snowfall at places where no permanent observers can be obtained. Experiments have been carried out under the direction of Prof. F. H. Bigelow for this purpose. A large number of stations have been equipped with comparative apparatus, as follows: (1) Snow bins, or cubical boxes, 5 feet on a side, standing on a frame so that the top is 10 feet above the ground; (2) standpipes, 10 inches in diameter and 10 feet high; (3) platforms, 10 feet square on the ground; (4) vertical scales, graduated in feet and tenths; and (5) the ordinary small snow gauge used by the Weather Bureau for many years.

Observations made during the winter of 1909–10 indicate that the snow bins, fitted with a system of louvers on the inside to prevent the wind from blowing out the snow and to insure a level deposit within, catch very nearly the actual amount of fall. The standpipe fails to catch the right amount of snow by 20 per cent to 50 per cent. The wind drifts the snow on or off the platforms, making the measurements wholly unreliable. The catch of the small snow gauges is also rendered imperfect by wind eddies, which blow around the opening of the cylinder and carry a portion of the snow past the mouth without depositing it. The vertical snow scales are placed against trees or posts to show the depth of the snow lying on the ground at a given time. Further experiments will doubtless soon develop the best practical form of apparatus.

EVAPORATION STUDIES.

The evaporation observations and studies, which were begun in 1907, have been continued during the year under the direction of Professor Bigelow, who is now preparing a report summarizing these

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observations. A few facts taken from the records of observations at the "Salton Sea" will serve to show the magnitude of the problem under consideration. At tower No. 1, about 1,500 feet inland from the water, pan No. 1, on the ground, gave a total evaporation for the year of about 165 inches, and pan No. 5, 40 feet above the ground, 193 inches. At tower No. 2, 500 feet from the shore, pan No. 1 swings about 2 feet above the surface of the water, it having been found impossible to float the pans successfully without going to great expense. This pan evaporated about 108 inches during the year, and pan No. 5, 45 feet above the water, evaporated 137 inches. At tower No. 4, 1½ miles from the shore, pan No. 1, swinging about 2 feet above the water, evaporated 106 inches, and pan No. 5, 45 feet above the water, evaporated 140 inches. There was therefore a difference of about 30 inches of evaporation near the water surface of the sea and that taking place 40 feet higher.

The records from the United States Geological Survey indicate that the "Salton Sea" has been falling at the rate of about 55 inches annually for the past three years. While it is not known exactly how much water is flowing into the lake through the New and Alamo rivers and from the precipitation on the neighboring country, it may be estimated that it is not over 15 inches, so that the total annual evaporation from the surface of the sea is probably about 70 inches.

Our experiments have shown that pans of different sizes evaporate at very different rates—a 2-foot pan being represented by the coefficient 0.042, a 4-foot pan by the coefficient 0.036, and a 6-foot pan by the coefficient 0.031. The pans on towers Nos. 2 and 4 were each 4-foot pans. It is not now known what the corresponding coefficient of evaporation is for the surface of the sea, but it is probably something like 0.027. If an allowance of 25 per cent is made for the probable coefficient between the 4-foot pan and the large surface of the sea, it would reduce the apparent evaporation to 90 inches. This will be further reduced by computations depending upon the temperature of the water of the sea probably to about 75 inches, which approximates the actual amount observed as above stated. These facts indicate how unsafe it has been to proceed from the observations on a pan placed upon the shore of a body of water to the corresponding water surface, and the necessity of the programme inaugurated by the Weather Bureau has been amply justified. It is hoped that the final report will be successful in clearing up this last part of the problem regarding the coefficient of evaporation on the large water surface. The formula first used at Reno, Nev., by Professor Bigelow has been verified and proved efficient, working equally well in the dry regions of the West and the humid districts of the Eastern States. The wind coefficient is 0.070 instead of 0.0175 as first obtained at Reno. At that time it was not known that the size of the pan was so important in the phenomena of evaporation, and on that account it was not deemed necessary in the preliminary campaign to secure the wind coefficient with such precision. The cooperation with the Reclamation Service and the United States Geological Survey has been very important, and we have now secured corresponding observations at about 25 stations in the United States. These data, when published, will give a very good idea of the amount of evaporation, but it is evident that the entire subject is one that will always need careful supervision. The wind effect is so powerful that in all cases an anemometer must

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be placed immediately at the evaporating pan, and the coefficient of evaporation is such that great caution must be used in making the transition from the evaporation on the shore to the corresponding evaporation over a large water surface. It seems probable that the same coefficient of evaporation exists over the entire lake, except within a comparatively few feet of the shore, where land effect merges with the water effect.

It has been found by special experiments that the "Salton Sea" ceases to exercise any influence upon evaporation during the summer at a distance of about 1,000 feet from the shore. This would indicate that there is no effect of the sea by way of changing the climate of the country about its neighborhood.

The phenomena of evaporation should be developed fully in connection with forest and plant growth, and for this purpose the Weather Bureau is cooperating with the Forest Service at the Coconino Forest Experiment Station near Flagstaff, Ariz., and at Fremont, near Manitou, in Colorado.

NEW TEMPERATURE NORMALS.

In Weather Bureau Bulletin S, "Report on the Temperatures and Vapor Tensions of the United States," the monthly mean temperatures reduced to a homogeneous system for about thirty-three years' record have been collected for stations having a long record, about 100 in all.

A series of 481 charts, covering the interval from January, 1873, to December, 1909, inclusive, with corresponding annual charts, has been prepared showing the monthly and annual temperature departures from these long-record normals for the United States. Copies of these charts are being printed, and when assembled will give a complete history of this important phenomenon for more than a third of a century. By using these charts the current short-record normals of any station may be corrected to the corresponding thirty-three-year normal, and this will be undertaken later.

MARINE DIVISION.

This division is charged with the ocean and lake meteorological work, the supervision of the wireless-telegraph weather service, and the work of the vessel-reporting service.

While the collection, compilation, computation, and publication of all ocean meteorological data from vessels traversing the oceans and lakes are by law under the Weather Bureau, a duplicate of the information published by the Weather Bureau has to be furnished to the Hydrographic Office of the Navy Department. The act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1911, provides that—

> Hereafter the pilot charts prepared in the Hydrographic Office shall have conspicuously printed thereon the following: "Prepared from data furnished by the Hydrographic Office of the Navy Department and by the Weather Bureau of the Department of Agriculture, and published at the Hydrographic Office under the authority of the Secretary of the Navy;" and all meteorological information received by the Weather Bureau of the Department of Agriculture necessary for and of the character of such information heretofore used in the preparation of the pilot charts shall continue to be furnished with all possible expedition to the Hydrographic Office for use in the preparation of said charts.

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COLLECTION AND DISTRIBUTION OF DATA.

The American consuls at 89 of the principal foreign ports have assisted the Bureau in the distribution of marine forms, cloud and ocean charts, and pamphlets of instructions, and in the collection of meteorological observations from vessels.

The Weather Bureau marine centers are equipped with a standard mercurial barometer, thermometers, and shelter, and have a supply of all ocean meteorological forms, cloud charts, gnomonic charts, and meteorological charts. Assistants have been assigned to special duty in connection with marine work at New York, Philadelphia, and Seattle; at the latter point the official will have supervision over the entire traffic entering Puget Sound.

During the year 2,168 vessels of every nationality cooperated with the Weather Bureau in reporting pressure, temperature, wind, and other meteorological data, forwarding to the Marine Division in all about 10,000 weather report books. The data thus obtained are entered in the daily synoptic charts used in making the averages for the meteorological charts issued by the Weather Bureau and in preparing the information for the pilot charts issued by the Hydrographic Office.

Calendars containing useful information for captains and observers were distributed to all cooperating vessels, separate calendars being furnished for the Atlantic and Pacific oceans.

CHARTS PREPARED AND ISSUED.

DAILY SYNOPTIC CHARTS.—The daily observations received from the vessels are entered on these charts, which are used in tracing storm tracks and in preparing statements of average conditions of wind and weather for publication in the pilot and meteorological charts.

PILOT AND METEOROLOGICAL CHARTS.—The entire data for the North Atlantic charts have been revised and are practically complete. These charts contain normals of pressure and temperature covering a period of eighteen years; wind roses for twenty-five years, percentage of gales and calms for each 5° square and of fog for each 1° square of latitude and longitude, and trade-wind limits, all based on a large number of observations. On the back of the meteorological chart for September the origin and course of the West Indian hurricane of September 16–21, 1909, are graphically shown and its history briefly given.

The fog data on the North Atlantic chart have been extensively used by Mr. H. C. Thomson, engineer in charge of the survey for a short-line railway and steamship route to Europe, in his report to the governor-general of Newfoundland and others interested. It is also noted that the English meteorological office has used our fog data and shading to a great extent on their North Atlantic chart.

The South Atlantic charts are published quarterly, and with the charts for the quarter for September–November the data are complete, being based on normals of pressure for ten years, of temperature for fifteen years, and of wind roses (direction and force with percentage of gales and calms) for twenty-five years, and on the average conditions of wind and weather and trade-wind limits.

The revision of the data for the North Pacific charts has been brought up to the year 1909. The charts now contain normals of

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pressure for twenty years, of temperature for twenty-one years, of wind roses (force and direction) for twenty-five years, and of the percentage of gales and calms and trade-wind limits, all deduced from a large number of observations for each 5° square of latitude and longitude. These charts will be revised each year and additional storm tracks entered thereon.

Work on the monthly charts of the Indian Ocean is under way. Beginning with the month of January, pilot and meteorological charts will be published containing data similar to that on the North Atlantic charts, including the paths of the more severe storms and the limits of fog.

The compilation of data for a meteorological chart of the Great Lakes is well in hand. With January, 1911, a monthly meteorological chart will be published containing all the meteorological features and the tracks of the more severe storms that have passed over that region each month for the last ten years.

In connection with the storm tracks traversing the North Pacific Ocean, I desire to invite attention to the kind cooperation of the Zikawei Observatory, in charge of Professor Froc, in furnishing the results of the compiled data and study of Père H. Gauthier in portraying the approximate tracks of storms in the middle and higher latitudes of the North Pacific Ocean. The Hongkong Observatory has also given us valued material, while the India Observatory at Simla, India, the Australian meteorological service, the Weather Bureau of the Philippine Islands, and the meteorological service of Canada have kindly furnished all available data. Publications of the other meteorological services have been used for study and reference.

WIRELESS TELEGRAPH SERVICE.

On account of the falling off in the number of vessels leaving San Francisco, very few wireless observations were received there during the year. The service to Portland, Oreg., has been continued throughout the year. From 20 to 75 reports are received each month at that station, but the official in charge states that only about 26 per cent are of benefit in his forecast work, the barometer readings and wind and weather being of most value. More than half of the reports are received too late for use. These messages are sent and received without expense to the Bureau, through the courtesy of the vessel captains, the United Wireless Company, and the naval wireless stations. Many of the reports are received at Katalla or Cordova, Alaska, and forwarded by cable free of cost.

VESSEL REPORTING STATIONS.

In addition to their meteorological work the stations at Block Island, Cape Henry, Jupiter, Sand Key, Southeast Farallon, North Head, Point Reyes, Port Crescent, and Tatoosh Island are required to report all passing vessels, wrecks, and marine disasters and casualties, and to transmit all communications between masters, owners, underwriters, and others interested. The stations at Cape Henry, Jupiter, Sand Key, Southeast Farallon, Point Reyes, North Head, and Tatoosh Island are equipped for signaling by the international code, and are prepared to transmit messages by telegraph.

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Sand Key can also send and receive messages by flash light (Morse code). Each station, immediately upon sighting a vessel, sends a message to the owners and the maritime exchanges. All the stations cooperate with the Life-Saving Service in rendering assistance to wrecks and vessels in distress.

Cape Henry has 89 correspondents on its list, the telephone being used in reporting to Norfolk and Newport News. That office also cooperates with the Maryland Pilot Association, and such vessels as do not burn night signals are reported each morning by the pilot boats. All naval vessels are reported to Norfolk, and in some cases to the Navy Department at Washington. A daily list of vessels that pass is sent to the press in Norfolk. The office is kept open day and night. A flag is dropped at noon each day, giving the noon hour to the pilot boats and other vessels in the offing. A new code for communicating with tugboats of the Baltimore Chamber of Commerce that may be in the offing went into use in October, 1909. For night signaling purposes an acetylene plant will shortly be installed at Cape Henry.

During the year Block Island reported 15 passing vessels, Jupiter 542, North Head 1,643, Point Reyes 1,131, Port Crescent 334, Sand Key 1,552, Southeast Farallon 199, Tatoosh Island 2,368, and Cape Henry 19,755, making a total of 27,539 vessels. Often each message is sent to from three to six different interested parties, thus making the work enormous. In addition to this, Cape Henry reported 12 wrecks, and 725 vessel orders were received and delivered.

Only two complaints were made of poor service, and upon investigation they were found to be due to the fault of the vessel captains.

As an instance of the efficiency of the service, the observer at Point Reyes Light noticed that a vessel, the *Charles Wilson*, off the point, was rapidly drifting shoreward and was likely to be dashed against the rocks. He at once signaled the vessel, notified the San Francisco office of the Weather Bureau, and hoisted the distress signal and the signal "want tugboat." The steamboat *Dispatch* recognized the signals and went to the assistance of the helpless vessel.

Letters of commendation of the vessel-reporting service were received from the maritime exchanges at New York, Philadelphia, Baltimore, Norfolk, and Newport News. I will quote one from New York, others being similar in their nature:

> We wish to express our appreciation of the valuable services rendered by the Weather Bureau stations in reporting to us the movements of vessels, particularly the Cape Henry (Va.) and Jupiter (Fla.) stations. The observers at these stations are very capable men and fully understand our needs in the way of prompt and accurate reports of vessel movements.

LIBRARY.

The additions to the library during the year numbered 1,291 books and separate pamphlets, all of which have been catalogued under author and subject. The total strength of the library is now well over 30,000 volumes.

The more important meteorological contents of about 100 scientific periodicals have been regularly catalogued under author and subject. As in previous years, select lists of the current additions to the catalogues of both books and periodical literature have been published

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regularly in the Monthly Weather Review, constituting a running bibliography of meteorology, climatology, and seismology.

The following is a retrospect of the more important literary events of the year in meteorology, as reflected in the growth of the library:

The only general treatise on meteorology that has appeared in America for several years was "Descriptive Meteorology," written by the Chief of this Bureau and published early in the spring. The Smithsonian Institution brought out Prof. Cleveland Abbe's "Mechanics of the Earth's Atmosphere—Third Collection," comprising translations and reprints of most of the substantial contributions to this subject in recent years, together with a few earlier memoirs of great interest. The British Meteorological Office published an English version of Hildebrandsson & Hellmann's "Codex of Resolutions Adopted at International Meteorological Meetings, 1872–1907," which places in compendious form the results of international cooperation extending over the past thirty-five years.

One of the most noteworthy publications of the year was the concluding installment of the only large modern treatise on atmospheric optics, viz, "Meteorologische Optik," begun by the late J. M. Pernter and completed by F. M. Exner.

Dr. J. Hann published the second part of the much enlarged third edition of his "Handbuch der Klimatologie." Important climatographic works included many additional parts of the United States Weather Bureau's "Summary of the Climatological Data for the United States, by Sections." Two large works dealing with the climatography of whole countries were G. Roster's "Climatologia dell' Italia," and the text volume of "Das Klima der Schweiz," by Dr. J. Maurer and his official colleagues. Two more parts of the "Klimatographie von Österreich," dealing, respectively, with Styria and with the Tyrol and Vorarlberg, were issued by the K. K. Zentralanstalt für Meteorologie at Vienna. The winds of two countries were discussed, especially with a view to the requirements of aeronauts, in F. Eredia's "I venti in Italia" and R. Assmann's "Die Winde in Deutschland." A valuable contribution to the climatography of South Africa was published by E. Goetz in his "Rainfall of Rhodesia."

The rapid growth of aerology—the exploration of the free atmosphere—was represented by several notable works, including Gold & Harwood's report on "The Present State of our Knowledge of the Upper Atmosphere," presented at the Winnipeg meeting of the British Association; A. Wagner's "Temperaturverhältnisse in der freien Atmosphäre," issued as a double number of Beiträge zur Physik der freien Atmosphäre; a publication of the British Meteorological Office entitled "The Free Atmosphere in the Region of the British Isles;" and A. Berson's "Bericht über die aerologische Expedition des Königlichen Aeronautischen Observatoriums nach Ostafrika."

A work on weather forecasting that aroused much controversy was G. Guilbert's "Nouvelle méthode de prévision du temps." A new method of long-range forecasting was described by S. D. Griboiedov in a memoir published in Russian and presented at the National Congress of Meteorologists held last year in St. Petersburg. Of great interest to students of the history of meteorology was the translation of Seneca's "Quæstiones naturales," by J. Clarke, published under the title "Physical Science in the Time of Nero." A most

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useful bibliographic publication was the general author and subject index to the Meteorologische Zeitschrift, volumes 1–25. Bibliographies of special topics included a reprint from the Monthly Weather Review of Mrs. G. J. Livingston's "Annotated Bibliography of Evaporation," and P. Brockett's "Bibliography of Aeronautics," the latter published by the Smithsonian Institution.

During the year the librarian visited several scientific and general libraries in Europe, including that of the Ufficio Centrale di Meteorologia, in Rome; the Laurentian Library, in Florence; and the library of the Royal Observatory of Belgium, at Uccle.

EXAMINATIONS FOR PROMOTION.

The total number of examination papers received and rated during the year was 258, as compared with 223 during the preceding year. Following is the record in detail:

Subject.	1909.		1910.		Total.	Passed.	Failed.
	August.	November.	February.	May.			
English grammar	9	10	14	16	49	37	12
Arithmetic	4	10	14	8	36	27	9
Elementary meteorology	7	12	11	11	41	40	1
Essay writing	7	5	8	9	29	20	9
Algebra	4	4	5	4	17	15	2
Physics	3	3	6	10	22	21	1
Trigonometry	5	5	7	8	25	23	2
Astronomy	4	2	3	5	14	14	0
Plant physiology	1	3	2	4	10	10	0
Advanced meteorology	0	2	8	5	15	13	2
Total	44	56	78	80	258	220	38

SCHOOL OF INSTRUCTION.

The work of instructing probationary appointees has continued along the lines pursued during the previous year, except that more attention has been given to map making, especially the making of stencil or milliograph maps.

By the time they have finished their course of preliminary instruction at the central office, the student observers have a fair idea of the method of handling official correspondence, and a number of them are quite proficient in sending and receiving telegraphic messages. Upon arriving at stations they are already qualified to make maps, take observations, prepare meteorological forms, and perform the various other station duties.

Thirty-six men received instruction during the past year, and all but eight had been given station assignments at its close.

DISTRIBUTING DIVISION.

Owing to lack of funds the extension of forecast distribution during the year was much smaller than it would have been could advantage have been taken of the many favorable opportunities that from time to time were presented. At its close the number of places receiving forecasts at government expense was 2,180. In recent years

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the greatest extension of forecast distribution has been made through the cooperation of telephone companies, and it has been mainly through such cooperation that the distribution has been maintained without impairment. In fact, notwithstanding the reduced number of distributing centers receiving the forecasts at government expense, the forecasts have been made available to 537,000 more telephone subscribers than received the service at the close of the preceding year, the total number now being about 3,681,000. Funds not being available, advantage could not be taken of any of the opportunities afforded by the extension of the Rural Free-Delivery Service of the Post-Office Department.

The following table shows in detail the distribution of daily forecasts and special warnings in the several States by the various means employed:

Distribution of daily forecasts and special warnings.

State.	At government expense.			Without expense to the United States by—				
	Forecasts and special warnings.	Special warnings only.	Emergency warnings.	Mail.	Rural delivery.	Telephone.	Railroad train service.	Railroad telegraph.
Alabama	35	3	139	1,232	781	13,195	0	66
Arizona	5	0	0	177	0	7,460	0	0
Arkansas	27	6	107	940	517	22,603	0	14
California	100	44	0	1,265	2,883	101,383	0	0
Colorado	11	62	38	923	914	36,138	0	0
Connecticut	10	0	48	1,401	50	72,300	138	1
Delaware	8	0	16	111	296	4,865	0	27
District of Columbia	0	0	0	1,725	0	20,000	0	1
Florida	35	113	52	1,010	220	8,268	0	69
Georgia	34	31	239	2,161	832	34,350	0	149
Idaho	15	1	0	613	200	13,680	0	0
Illinois	120	1	402	2,386	2,835	376,799	0	17
Indiana	117	1	221	2,347	1,818	175,466	0	71
Iowa	142	5	381	1,993	4,187	171,389	25	0
Kansas	94	1	175	1,015	2,310	306,709	0	51
Kentucky	44	32	84	1,843	806	47,565	0	1
Louisiana	77	23	49	644	143	17,034	0	18
Maine	13	1	39	1,151	802	14,406	0	0
Maryland	20	4	46	1,781	575	7,691	0	65
Massachusetts	16	11	58	3,108	210	9,450	77	0
Michigan	69	1	326	4,974	348	216,796	279	387
Minnesota	75	5	181	2,314	4,100	137,901	0	13
Mississippi	45	6	108	1,205	886	34,611	0	6
Missouri	31	1	146	3,436	2,121	304,347	0	52
Montana	12	21	13	408	50	5,911	0	0
Nebraska	75	1	217	1,141	408	210,717	0	0
Nevada	6	0	0	74	0	967	0	0
New Hampshire	14	0	33	910	1,409	2,397	15	0
New Jersey	23	18	105	1,220	100	27,778	0	179
New Mexico	11	1	0	78	0	3,541	0	8
New York	128	45	351	7,190	2,194	332,506	207	163
North Carolina	81	11	164	777	2,030	27,705	0	0
North Dakota	23	0	93	189	1,919	16,453	0	0
Ohio	81	169	310	5,880	830	540,137	24	34
Oklahoma	32	1	16	722	1,104	6,994	0	130
Oregon	9	1	0	458	183	16,465	0	0
Pennsylvania	86	11	137	3,814	1,718	160,459	1	449
Rhode Island	2	0	12	478	0	1,163	13	0
South Carolina	29	9	105	948	636	10,076	0	38
South Dakota	63	10	76	807	183	49,174	0	0
Tennessee	52	3	285	1,187	1,055	39,344	0	3
Texas	63	46	227	1,460	1,188	71,551	0	63
Utah	5	23	0	300	661	34,277	0	0
Vermont	13	0	44	483	461	20,461	12	0
Virginia	61	4	118	1,283	2,124	31,204	101	72
Washington	25	1	0	787	1,091	11,023	0	0
West Virginia	28	7	51	849	7	34,924	0	17
Wisconsin	108	6	306	2,520	2,110	55,063	0	0
Wyoming	7	2	8	128	0	6,710	0	0
Total	2,180	742	5,526	73,846	49,295	3,680,905	892	2,159

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To show the status of the distributing work of the Bureau in recent years, its growth, and by some methods its curtailment, the accompanying table has been prepared. From this statement it will be seen that the telephonic distribution has been materially increased, notwithstanding the decrease of 190 in the number of stations receiving forecasts at government expense. The mail distribution has, however, suffered a slight decrease.

Year.	At government expense.			Without expense to United States by—				
	Forecast and special warnings.	Special warnings only.	Emergency warnings.	Mail.	Rural delivery.	Telephone.	Railroad train service.	Railroad telegraph.
1903-4	2,076	983	6,152	77,605	83,639	152,302	2,423	2,655
1904-5	2,158	973	6,152	77,774	75,602	464,738	2,423	2,443
1905-6	2,150	767	5,998	76,719	82,466	1,014,285	2,514	2,145
1906-7	2,280	734	5,998	78,109	71,300	1,985,905	1,423	2,134
1907-8	2,334	690	5,998	76,154	58,008	3,553,067	852	2,139
1908-9	2,370	782	5,998	77,563	53,402	3,143,985	883	2,305
1909-10	2,180	742	5,526	72,121	49,295	3,680,905	892	2,159

It is estimated that of the $260,000 appropriated for telephone rentals, telegraphing, etc., for the year 1909–10 the Bureau expended in distribution of daily forecasts and special warnings and for storm-warning messages approximately $73,000, or about 28 per cent, of which 25 per cent was used for the daily forecast service and 3 per cent for special warnings of cold waves and frosts and for storm-warning messages.

STORM-WARNING DISPLAY STATIONS.

A storm-warning display station was established at Rockport, Mass., and arrangements were completed for the establishment of two others, one at Grand Marais, Minn., and one at Singers Island, Michigan. Three cooperative storm-warning display stations, viz, Everett, Wash., Neah Bay, Wash., and Vermilion, Ohio, were changed to a paid basis. One paid and nine cooperative stations were discontinued. Those discontinued were stations at which the information could be as readily and conveniently obtained from near-by sources. The station at Rockport, Mass., has supplied an important need, and the proposed stations in the western Lake Superior region will undoubtedly prove valuable additions to the system of storm-warning display stations.

The storm-warning display stations received the usual careful attention, 130 having been inspected during the year.

A circular was issued to all storm-warning distributing centers on the Atlantic and Gulf coasts at the close of the year, having for its object a revival of interest in the plan of disseminating information regarding hurricanes, with special reference to warning people living in districts in which unusually high tides might cause loss of life and property.

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The following statement gives the number of stations, arranged under district centers, receiving storm warnings:

Centers.	Paid stations.	Cooperative stations.	Weather Bureau stations.	Naval wireless stations.
Alpena, Mich	6	0	1	0
Atlantic City, N. J	0	4	1	0
Baltimore, Md	3	1	0	0
Block Island, R. I	1	0	1	0
Boston, Mass	24	7	2	4
Buffalo, N. Y	11	1	1	0
Cape May, N. J	1	0	0	0
Charleston, S. C	5	1	1	0
Chicago, Ill	25	2	1	1
Cleveland, Ohio	10	0	1	0
Corpus Christi, Tex	2	0	1	0
Detroit, Mich	0	1	1	0
Duluth, Minn	5	0	1	0
Eastport, Me	0	1	1	0
Erie, Pa	1	0	1	0
Escanaba, Mich	2	0	1	0
Eureka, Cal	0	1	1	1
Galveston, Tex	4	4	1	0
Grand Haven, Mich.[a]	0	0	1	0
Green Bay, Wis.[a]	0	0	1	0
Houghton, Mich	2	2	1	0
Jacksonville, Fla	6	11	1	0
Jupiter, Fla	1	0	1	0
Key West, Fla	0	0	2	0
Los Angeles, Cal	1	3	0	0
Marquette, Mich	1	0	1	0
Milwaukee, Wis	9	0	1	0
Mobile, Ala	4	2	1	0
Nantucket, Mass.[a]	0	0	1	0
New Haven, Conn	2	0	1	0
New Orleans, La	3	1	1	0
New York, N. Y	5	3	2	2
Norfolk, Va	6	6	4	1
Oswego, N. Y.[a]	0	0	1	0
Pensacola, Fla	4	0	1	0
Philadelphia, Pa	3	0	2	0
Port Huron, Mich	4	1	1	0
Portland, Me	3	2	1	0
Portland, Oreg	9	3	6	0
Providence, R. I	1	0	1	0
Rochester, N. Y.[a]	0	0	1	0
San Diego, Cal	0	2	1	1
Sandusky, Ohio[a]	0	0	1	0
San Francisco, Cal	2	5	4	3
San Juan, P. R	0	0	0	2
Saulte Ste. Marie, Mich	5	0	1	0
Savannah, Ga	4	1	1	0
Tampa, Fla	3	2	1	0
Toledo, Ohio[a]	0	0	1	0
Wilmington, N. C	3	2	1	0
Total	181	69	61	15

[a] Not centers.

STATION PUBLICATIONS.

Early in 1910 the policy was adopted of discontinuing the station weather maps wherever the newspapers would undertake their publication. The announcement of this purpose met with a cordial response from the press. The first "commercial weather map," as it has been called, was published in the Minneapolis Journal on March 1. Within the four months following its publication has been extended to 65 morning and evening papers in 45 cities, while 55 additional stations will introduce the method as soon as suitable outfits can be supplied, which will probably be during the coming August. By this plan of publication the weather chart is placed before the public twice daily, and reaches millions of people where

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it reached thousands before. Some opposition to the plan has naturally been experienced in a few quarters where special purposes were served by the somewhat more elaborate charts formerly issued, but for purposes of study or for permanent file, the large Washington map remains available to those willing to pay its subscription price. I have no doubt that the change has resulted in vastly increasing the benefits of the map to the public in general, while the saving effected by discontinuing the printing at government expense will permit the extension of the work of the Bureau along other lines of usefulness.

The publication of the daily weather bulletin has been continued at all stations heretofore issuing this form of report, with materially increased editions.

EXAMINATION OF METEOROLOGICAL FORMS.

The principal record kept at Weather Bureau stations and the record kept by cooperative observers are examined, and the accuracy of the data verified or corrected, by the examining force of the Distributing Division. These records were received, examined, and verified or corrected for 195 Weather Bureau stations and more than 3,600 cooperative stations.

TELEGRAPH DIVISION.

The telegraph and telephone lines operated by the Weather Bureau have been kept in good order without any general repairs having been made.

The line from Port Crescent to Tatoosh Island, Washington, worked better than ever before. The line from San Francisco to Point Reyes is in poor condition, but as there is a commercial telephone line from San Francisco to Inverness, which is but a short distance from our station at Point Reyes, it may be cheaper to make some arrangement with the Pacific States Telephone and Telegraph Company to pay them regular tolls on each message sent between San Francisco, Mount Tamalpais, and Point Reyes and do away with the government wire altogether. This would save the rental of leased wires between San Francisco and Mill Valley, as well as the expense of keeping the line in order.

The lines and cables from Charlevoix to Beaver Island, Michigan, and from Glen Haven to South and North Manitou islands, Michigan, have been kept in good working order by the life-saving crews without expense to the Weather Bureau, except for material. The cable between Charlevoix and Beaver Island was broken by the United States dredge *General Gillespie* on August 24, 1909, and was repaired four days later at small cost, the life-saving crew assisting.

The line from Alpena to Thunder Bay and Middle Island, Michigan, has been kept in good working order, but the poles are now seventeen years old and will shortly require cutting off and resetting, and in some places new poles will have to be furnished.

The submarine cable from Key West to Sand Key, Florida, has worked satisfactorily the entire year without repairs.

The line from Norfolk, Va., to Hatteras, N. C., has been kept in good order during the entire year. The life-saving crews, every 5

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miles apart from Cape Henry to Hatteras, have rendered prompt and valuable assistance in this work.

The Block Island line has worked excellently during the entire year and has been maintained with slight expense.

The arrangements with the different commercial telegraph companies for handling the daily weather reports throughout the world have been very satisfactory. The average time of transmission to the central office from all points is about one hour.

The work of auditing the telegraph and telephone accounts of the Bureau is well up to date. The government receipts from all lines for commercial messages handled during the year were $1,710.66.

The requests for additional weather reports by telegraph from the various observing stations were unusually numerous, exceeding those for any single year in the previous history of the Bureau. While public requirements in this respect have been met as far as possible by a reorganization of the Bureau's system of "circuit" reports, the demands were more than could be satisfied with the present fund available for telegraphic expenses.

PUBLICATIONS DIVISION.

The Publications Division has continued to print and to supply to stations the necessary blank forms, maps, and cards, and has continued the issue of the regular publications of the Bureau, such as the daily weather map, the Monthly Weather Review, the Bulletin of the Mount Weather Observatory (quarterly), the National Weather Bulletin (weekly and monthly), and the Snow and Ice Bulletin (during the winter season). As heretofore, the Government Printing Office has done all the binding required by the Bureau, and has also printed a few reports that could be more economically handled there.

The material change that was made in the character of the Monthly Weather Review during the year added so largely to its mechanical work that it became necessary to install a larger folding machine and an equipment of type-setting machinery. This permits a more rapid output of the printing office and has improved the typographical appearance of the work.

DIVISION OF SUPPLIES.

In conformity with an executive order effective July 1, 1909, all supplies for the Bureau not covered by special department contracts for articles of a technical nature were purchased, so far as listed, under the contracts prepared by the general supply committee. As this inaugurated a system of unifying and standardizing the miscellaneous supplies used in common by all of the Executive Departments, and involved the setting aside of individual preferences, some friction developed during the first year of its practical application, though in this Bureau to a less degree than might reasonably have been expected. In some instances out-of-town contractors declined to fill small orders; in others the articles under contract were inferior in quality or unsuitable to the purpose for which they were desired; and as no samples were furnished by the committee, it was impossible to determine whether or not such articles were up to their accepted samples. List prices with three or four discounts were also a

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constant source of vexation. These and other incongruities were brought to the attention of the committee when occasion offered. It is believed that there will be fewer difficulties of this character experienced hereafter.

Most of the technical supplies heretofore covered by the departmental contracts were included in the general contracts for the coming year.

OBSERVATORY BUILDINGS.

The main observatory building of the Weather Bureau at Mount Weather, Va., has been completed and was first occupied on February 12, 1910. It is practically a fireproof structure, especially designed to meet the requirements of the Bureau for office and living quarters for the investigators and employees on duty at the research observatory. The building replaces the one that was destroyed by fire on October 23, 1907, and it is the last structure that will be required at that point for the present.

The observatory building located on Sand Key, Florida, a few miles from Key West, was completely destroyed by a hurricane on October 11, 1909. Congress has made appropriation for the reconstruction of the building, the plans of which are now in course of preparation, and it is hoped that this work will be completed before January 1, 1911. The proposed building will be composed of concrete, with a foundation of concrete piles driven into the solid rock. It is believed that this type of building will withstand future hurricanes and will involve a minimum cost for maintenance.

Seven observatory buildings were authorized in the appropriation bill for the fiscal year 1909. They were erected at Abilene, Tex., Canton, N. Y., Dodge City, Kans., East Lansing, Mich., Northfield, Vt., Richmond, Va., and St. Joseph, Mo., during the past year and are now occupied.

The following table shows where the buildings owned by the Weather Bureau are located, the fiscal years in which they were erected, and the cost of the buildings and grounds:

Buildings owned by the Weather Bureau.

Location.	Erected.	Cost of ground.	Cost of buildings.	Total cost.
Abilene, Tex.	1909	$2,000.00	$12,841.81	$14,841.81
Amarillo, Tex.	1903	1,255.00	6,503.00	7,758.00
Anniston, Ala.	1907	1,799.75	12,920.69	14,720.44
Atlantic City, N. J.	1902	(a)	5,991.00	5,991.00
Bentonville, Ark.	1906	500.00	5,119.90	5,619.90
Birmingham, Ala.	1907	b 61.50	15,630.36	15,691 86
Bismarck, N. Dak.	c 1899	(a)	10,085.99	10,085.99
Block Island, R. I.	1904	1,034.50	7,668.25	8,702.75
Burlington, Vt.	1906	b 20.00	10,043.50	10,063.50
Canton, N. Y.	1909	b 1.35	14,135.20	14,136.55
Cape Henry, Va.	1902	(a)	9,222.45	9,222.45
Charles City, Iowa.	1907	3,036.75	9,338.47	12,375.22
Columbia, S. C.	1905	3,799.00	9,165.00	12,964.00
Devils Lake, N. Dak.	1904	2,209.05	7,431.50	9,640.55
Dodge City, Kans.	1909	2,050.00	10,837.62	12,887.62
Duluth, Minn.	1904	2,041.70	7,430.68	9,472.38
East Lansing, Mich.	1909	b 11.35	12,781.04	12,792.39
Hatteras, N. C.	1902	a d 217.00	4,889.75	5,106.75
Havre, Mont.	1904	1,795.00	5,087.08	6,882.08
Iola, Kans.	1907	2,241.25	9,730.94	11,972.19

a Government reservation.
b Donated; figures represent cost of title transfer.
c Remodeled.
d Additional ground purchased.

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Buildings owned by the Weather Bureau—Continued.

Location.	Erected.	Cost of ground.	Cost of buildings.	Total cost.
Jupiter, Fla.	1902	(a)	$6,346.90	$6,346.90
Key West, Fla.	1903	$2,020.00	7,994.75	10,014.75
Kittyhawk, N. C.	[b] 1902	(a)	1,616.00	1,616.00
La Crosse, Wis.	1907	3,523.50	12,276.24	15,799.74
Modena, Utah.	1903	(a)	4,346.00	4,346.00
Mount Weather, Va.:				
Administration building.	1909	1,863.15	48,035.26	49,898.41
Machine shop and balloon shed.	1904	650.00	8,167.00	8,817.00
Central heating and power plant.	1909	(a)	11,964.74	11,964.74
Absolute building.	[c] 1906	(a)	7,000.00	7,000.00
Variation building.	[c] 1906	(a)	8,904.55	8,904.55
Stable.	1903	(a)	1,900.00	1,900.00
Barn.	1905	(a)	900.00	900.00
Cottage for workmen.	[b] 1905	(a)	1,300.00	1,300.00
Physical laboratory.	[d] 1909	(a)	37,521.51	37,521.51
Cottage and office.	[e] 1909	(a)	11,246.34	11,246.34
Nantucket, Mass.	1905	(f)	4,728.53	4,728.53
Narragansett Pier, R. I.	1904	4,151.75	8,036.50	12,188.25
Northfield, Vt.	1909	[g] 101.00	12,795.64	12,896.64
North Head, Wash.	1902	(a)	3,820.13	3,820.13
North Platte, Nebr.	1906	(f)	3,818.50	3,818.50
Oklahoma, Okla.	1906	[g] 38.90	10,520.25	10,559.15
Peoria, Ill.	1905	[g] 54.00	7,875.50	7,929.50
Point Reyes Light, Cal.	1902	(a)	2,875.00	2,875.00
Port Crescent, Wash.	1902	102.00	730.94	832.94
Richmond, Va.	1909	[g] 8.75	15,489.01	15,497.76
St. Joseph, Mo.	1909	5,040.95	16,882.80	21,923.75
Sand Key, Fla.	1903	(a)	(h)	(h)
Sault Ste. Marie, Mich.	1899	(a)	2,994.12	2,994.12
Sheridan, Wyo.	1907	2,021.75	12,089.30	14,111.05
Southeast Farallon, Cal.	1903	(a)	5,211.22	5,211.22
Springfield, Ill.	1906	(a)	10,236.50	10,236.50
Tatoosh Island, Wash.	1902	(a)	5,000.00	5,000.00
Washington, D. C.	.....	(f)	174,950.79	174,950.79
Yellowstone Park, Wyo.	1904	(a)	11,156.00	11,156.00
Yuma, Ariz.	[b] 1903	(a)	1,500.00	1,500.00
Total.	.....	43,648.95	667,084.25	710,733.20

[a] Government reservation.
[b] Remodeled.
[c] Begun in 1905.
[d] Begun in 1903.
[e] Begun in 1907.
[f] Building and ground purchased as a whole.
[g] Donated; figures represent cost of title transfer.
[h] Destroyed by a hurricane October 11, 1909.

Buildings rented by the Weather Bureau for living and observatory purposes.

Station.	Annual rent.	Other items included.
Alpena, Mich.	$650	Heat, light, water.
Cape May, N. J.	650	
Clallam Bay, Wash.	120	Water.
Del Rio, Tex.	444	Heat, light, water.
Durango, Colo.	318	Water.
Flagstaff, Ariz.	420	
Helena, Mont.	624	Steam heating plant, water.
Honolulu, Hawaii.	1,020	Six rooms; heat, cleaner, light, janitor, and porter service, electric current for fan, storage.
Independence, Cal.	456	Water for domestic and irrigation purposes, and the trimming and care of all trees on the premises.
Kalispell, Mont.	360	
Lewiston, Idaho.	540	
Manteo, N. C.	144	
Moorhead, Minn.	600	Heat, light, water.
Mount Tamalpais, Cal.	420	Heat, light, water, and the free transportation of government employees and supplies.
Pysht, Wash.	144	Water.
Roseburg, Oreg.	550	Heat, light, water.
Roswell, N. Mex.	720	Heat, cleaner, light.
San Juan, P. R.	600	Ten rooms.
Thomasville, Ga.	420	
Tonopah, Nev.	840	
Twin, Wash.	108	Water.
Williston, N. Dak.	510	Heat, cleaner, light, water.
Winnemucca, Nev.	480	Heat, light, water.
Total.	11,138	

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PERSONNEL OF THE BUREAU.

The total numerical strength of the Bureau at the close of the fiscal year was 6,895. Of this number more than two-thirds rendered service without compensation other than through the free receipt of government publications. The increase of 285 over the figures given at the close of the preceding year was mainly due to the employment of observers in connection with the extension of mountain snowfall investigation in the Western States, although more than a hundred were added to the lists of special meteorological observers and cooperative observers and correspondents; the number of employees engaged in the remaining lines of work remained practically unchanged.

The distribution of the 792 commissioned employees of the Bureau gave 210 to the central office at Washington and 582 to the stations throughout the country. This represents an increase of 6 and 14, respectively, in the record of similar assignments for the close of the preceding twelve months. At the central office the distribution of the employees among the several divisions remained practically as in the year before, except in the Publications Division, where an increase in the amount of printing necessitated an addition of 5 to the working force. At stations the transfer of the climatological work from Galveston to another point and the curtailment of special evaporation studies at Salt Creek Bridge, California, caused the working force at each of these stations to be reduced by three, while at a number of other points the force was lessened by one man through transfers to stations where the demands for additional help had become imperative. It is a fact that both in the central office and at stations the increase in the number of employees has not been proportionate to the increase in work; in other words, the operations of the Weather Bureau have been so enlarged during the past year as to require more work than formerly from each member of its commissioned force, despite the fact that the number was increased by 20 during that period.

In the classified service of the Bureau there were 4 more permanent appointments, including those effected by transfer and reinstatement, and 7 more temporary appointments than in the preceding year. The promotions during the same period—52 at the central office and 129 at stations—were fewer by 59 than in the year before. All promotions but 5 were made to the next higher grade; of the exceptions noted, 4 resulted through the assignment of especially meritorious employees to charge of important stations in large cities, where the enlarged duties and responsibilities called for appreciable increases in compensation, and the remaining instance was that of a central office employee possessing particular qualifications for the duties to which assigned. There were 53 voluntary resignations in the classified service during the year, or 11 more than in the preceding twelve months. By far the larger part was in the subclerical force, especially among the messengers and messenger boys, which was to have been expected, a less stability naturally belonging to the lower and less remunerative grades than elsewhere. A loss of 8 recently appointed assistant observers through resignation, however, was larger than looked for, and, in view of the time and attention required in their preliminary training, worked to the disadvantage

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of the Bureau. In order to better this condition recommendation was made to the Civil Service Commission, and favorably acted upon, that only unmarried men be eligible for appointment as assistant observers, owing to the low entrance salary as well as to the fact that in the earlier years of their service these appointees are liable to be moved from station to station frequently and at short notice. Of the 103 probationary appointments made during the year all but 3 successfully completed the six months' trial period. Nine undesirable employees were eliminated from the classified service during the year and 23 reductions were made by way of necessary discipline or for other sufficient reasons.

In the unclassified service there were 5 permanent and no temporary appointments, as compared with 6 permanent and 1 temporary for the preceding year.

The absence record differed but slightly from that for the calendar year preceding, there having been a fraction of a day less, both for sickness and for annual leave, the average for the entire service considered.

There were 8 deaths in the commissioned force of the Bureau, as against 3 for the year before. The list includes Prof. Edward B. Garriott, through whose death, on May 13, 1910, the Bureau lost one of its most valued officials and the science of meteorology an able investigator and enthusiastic student. Professor Garriott had for years been in charge of the forecast division of the central office.

CHANGES IN THE FORCE OF THE BUREAU.

CLASSIFIED SERVICE.

Appointments:	
Probationary—	
Compositors, at $1,250	4
Printers, at $1,000	5
Skilled mechanic, at $1,000	1
Clerk, at $900	1
Assistant observers, at $720	41
Carpenter, at $720	1
Repairman, at $720	1
Watchman, at $720	1
Firemen, at $720	2
Folders and feeders, at $630	3
Skilled laborers, at $450	3
Messenger boys, at $450	3
Messenger boys, at $360	37
	103
Transfer—	
Engineer, at $1,200	1
Printer, at $1,000	1
Messenger, at $600	1
	3
Reinstatement—	
Printers, at $1,000	2
Assistant observers, at $1,000	2
Assistant observer, at $720	1
Messenger, at $600	1
Messenger boy, at $480	1
	7

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Appointments—Continued.	
Temporary—	
Compositor, at $1,500	1
Compositors, at $1,250	5
Clerks, at $900	3
Repairmen, at $720	2
Fireman, at $720	1
Folders and feeders, at $630	2
Messenger boys, at $600	2
Messenger, at $480	1
Skilled laborer, at $450	1
Messenger boys, at $450	3
Messenger boys, at $360	27
Evaporation observer, at $3 a day	1
	49
Promotions (all promotions except 5 were to the next higher grade or by certification for advancement from subclerical positions)	201
Reductions:	
Causes—	
To grant assignment to preferred station	3
To grant assignment to preferred work	2
Necessitated by assignment to station duty	3
Necessitated by employee's return to duty from leave of absence without pay	1
Necessitated by civil-service ruling	1
Decreased efficiency due to increasing age	4
Physical disability	1
Absence without authority	1
Unsatisfactory services	7
	23
Resignations:	
Voluntary	53
Required because of—	
Unsatisfactory services	6
Unsatisfactory services and conduct	2
	61
Transferred to the office of the Secretary of Agriculture	1
Removals:	
Causes—	
Absence without authority	1
Unsatisfactory services	1
Unsatisfactory conduct	2
Indecent conduct	1
Gross impudence	1
Theft	1
Physical disability	1
Physical disability and unreliability	1
	9
Dropped from the rolls at termination of probationary period because of unsatisfactory services	3
Deaths	8

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UNCLASSIFIED SERVICE.

Appointments:	
Permanent—	
Unclassified laborer, at $480	1
Student assistants, at $300	3
Charwoman, at $240	1
	5
Promotion (to the next higher grade)	1
Resignations:	
Voluntary	3
Required because of—	
Unsatisfactory services	1
Unsatisfactory conduct	1
	5
Removal:	
Cause—	
Position filled by a classified employee	1

ABSENCE.

Average number of days per employee during calendar year 1909.

	Sickness.	Annual leave.
Station (99 per cent males)	1.0	7.2
Washington, D. C.:		
Males	5.4	24.6
Females	7.8	26.0
Entire service	2.2	11.7

STATISTICS OF THE SERVICE.

The following tables show the numerical strength of the Bureau and the highest, lowest, and average salaries paid in the commissioned grades:

Numerical strength of the Weather Bureau June 30, 1910.

At Washington, D. C.:		
Classified	199	
Unclassified	11	
		210
Outside of Washington, D. C.:		
Classified	566	
Unclassified	16	
		582
Total commissioned employees		792
Additional employees outside of Washington, D. C.:		
Storm-warning displaymen	181	
River observers	392	
Cotton-region observers	117	
Corn and wheat region observers	130	
Rainfall observers	107	
Sugar and rice region observers	7	
Special meteorological observers	74	
Special cranberry-marsh observers	4	

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Additional employees outside of Washington, D. C.—Continued.		
Special snow and ice observers	4	
Mountain snowfall observers	333	
Total noncommissioned employees		1,349
Total paid employees		[a] 2,141
Persons serving without compensation (except through the distribution of government publications):		
Cooperative observers and correspondents (omitting 415 paid observers enumerated elsewhere)	4,636	
Cooperative storm-warning displaymen	84	
Cooperative river observers	23	
Cooperative rainfall observers	11	
Total cooperatives		4,754
Total numerical strength		6,895

Distribution of the commissioned force, June 30, 1910.

In Washington, D. C.:	
Accounts Division	[b] 14
Climatological Division	16
Distributing Division	11
Executive branch	16
Forecast Division	7
Instrument Division	11
Library	4
Marine Division	13
Observatory	9
Publications Division	41
River and Flood Division	3
Supplies Division	[b] 10
Telegraph Division	11
Verification Section	2
Drafting room (under direction of the chief clerk)	4
Heat, light, and power plant (under direction of the chief clerk)	5
Miscellaneous mechanical work (under direction of the chief clerk)	6
Watch force (under direction of the chief clerk)	6
General messenger and laborer service (under direction of the chief clerk)	21
	210
Outside of Washington, D. C.:	
53 stations with 1 commissioned employee	53
51 stations with 2 commissioned employees	102
43 stations with 3 commissioned employees	129
18 stations with 4 commissioned employees	72
14 stations with 5 commissioned employees	70
10 stations with 6 commissioned employees	60
3 stations with 7 commissioned employees	21
1 station with 8 commissioned employees	8
2 stations with 9 commissioned employees	18
2 stations with 10 commissioned employees	20
1 station with 11 commissioned employees	11
1 station with 22 commissioned employees	22
199 stations	[c] 586

[a] This total embraces all paid persons connected with the Bureau on June 30, 1910, except 18 commissioned employees absent on that date and who had been granted leaves of absence or furloughs without pay for one month or more.

[b] One employee devotes a portion of his time at one of the map stations at the United States Capitol.

[c] This represents the normal station force. On June 30, 1910, there were actually on duty 582 employees.

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In addition to the foregoing there are eight special observing (one man) stations in the West Indies, mainly in operation during the hurricane season, and a special repair station in Washington, operated from October to April, inclusive.

The following salary table omits 3 evaporation observers, who receive pay only when they take observations, and persons on duty at special observing and substations where the salaries are $25 a month or less, and where, as a rule, the tour of duty covers but a small fraction of the day and only certain seasons of the year.

Salaries paid in the commissioned grades.

Grades.	June 30, 1910.	
	Stations.	Washington, D. C.
Classified grades:		
Highest salary	$3,000	$6,000
Lowest salary	360	450
Average salary	1,035	1,166
Unclassified grades:		
Highest salary	720	720
Lowest salary	300	240
Average salary	390	502

Average salary of all (station and Washington) is $1,051.

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REPORT OF THE CHIEF OF THE BUREAU OF ANIMAL INDUSTRY.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., September 28, 1910.

SIR: I have the honor to transmit herewith a report of the operations of the Bureau of Animal Industry for the fiscal year ended June 30, 1910.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

INTRODUCTION.

The work of the Bureau of Animal Industry during the fiscal year ended June 30, 1910, consisted, as heretofore, of the meat inspection, the inspection of animals for export, the inspection and quarantine of imported animals, the eradication of contagious and infectious diseases of live stock, the scientific investigation of such diseases, investigations in the breeding and feeding of live stock and poultry, and work relating to the dairy industry.

The employees in the service of the Bureau on July 1, 1910, numbered 3,183, as compared with 3,268 a year before. Of the former number 2,385 were engaged in meat inspection or work pertaining thereto, as compared with 2,499 on July 1, 1909.

MEAT INSPECTION.

As pointed out in my previous report, the meat inspection in the latter part of the fiscal year 1909 had about reached the limit of the standing annual appropriation of $3,000,000. Strict economy has been observed in this work so as to provide inspection to the greatest extent possible with the funds available. The cost of the inspection for the fiscal year 1910 was approximately $2,940,000.

While the inspection was carried on at 919 establishments in 237 cities and towns—an increase of 43 establishments over the preceding year—the total number of animals inspected was less, owing to a falling off in the number of hogs slaughtered. There was an increase in all other species. The total number of animals inspected at the time of slaughter was 49,179,057, as compared with 55,672,075 in the fiscal year 1909. Of the former number there were condemned be-

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cause of disease or other condition 113,742 entire carcasses and 874,211 parts of carcasses, making a total of nearly 1,000,000 animals condemned in whole or in part. In addition there were condemned on reinspection over 19,000,000 pounds of meat and meat products which had become unwholesome since inspection at the time of slaughter. More detailed figures relating to the meat inspection appear in the portion of this report dealing with the work of the Inspection Division.

Notwithstanding the great improvement in sanitary conditions brought about under the additional authority given the Department by the law of 1906, and the high degree of efficiency to which the service has been brought, the meat inspection is still occasionally the object of unjust criticism and misrepresentation. Some of these matters have been discussed in previous reports. Objection is sometimes made to the passing for food purposes of the meat of animals that are affected with localized tuberculosis or other localized disease or condition. It is sometimes falsely asserted that "diseased meat is passed for food." The only foundation for such statements is that the wholesome and healthy meat of an animal affected slightly and locally with some disease is passed, after the affected portion has been removed and condemned. The meat or flesh may not be affected in any particular, the disease being usually confined to certain glands or organs. The diseased portion is condemned; only the healthy portion is passed for food.

This procedure is justified and sustained by the highest scientific authorities not only in the United States but in all countries having an efficient meat inspection. Objections to it usually come from those who have not made a study of comparative pathology and who are not qualified to pass upon the questions involved, and sometimes they come from those who oppose the use of meat at all as food and who wish to discredit it in every possible way.

The idea of eating the meat of a slightly diseased animal may be repulsive to some, but a little consideration should readily convince a reasonable person that there is no valid reason for condemning and wasting perfectly wholesome meat simply because there happens to be somewhere in the animal a gland or an organ showing a lesion, or a parasitic nodule, or some slight, local condition which does not extend to or affect in any way the remainder of the carcass. The argument that all the meat of an animal affected to even the slightest degree with any disease should be totally and utterly condemned, if carried to the extreme and to its logical end, would result in the condemnation of practically every animal slaughtered and the abolition of meat as food.

With the increasing cost of the necessaries of life it becomes more important that wholesome food should not be recklessly and needlessly destroyed, and it is the duty of this Department not only to protect the people against unwholesome meat, but to conserve the food supply. The only sensible course in meat inspection is to determine at just what stage a disease or abnormal condition becomes noxious, and where to draw the line between what should be condemned and what should be passed, always giving to the consumer the benefit of any doubt. That the Department does properly safeguard the consumer is well shown in the report of a commission of eminent scientists outside the Department, who were appointed in 1907 by the

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Secretary of Agriculture at the suggestion of President Roosevelt to consider and make recommendations with regard to certain features of the meat inspection, and who stated as their conclusion that "if there be any general error in the regulation, this is in favor of the public rather than in favor of the butchers and packers."

With regard to the question now under discussion the commission said:

The commission would invite attention to a very widespread popular misconception as to the significance of the word "diseased" in connection with meat inspection. To the popular mind the idea of eating "diseased" animals is abhorrent. From the standpoint of meat inspection, however, the term "diseased" must be used in a sense not entirely in harmony with the popular conception of this word.

The commission could easily undertake to show that not any single animal used for food in any part of the world would, upon microscopic study, be shown to be absolutely free from all infection or lesion if said animal were presented to it for examination. Some persons might assert that in all of these infections and conditions the meat of the animals should be considered "diseased." Such interpretation is not, however, justified from a standpoint of meat inspection. A light sarcosporidiasis[a] in cattle, sheep, swine, or goats, for instance, would not justify the condemnation of a carcass, for there is no proof that such a condition depreciates, in even the remotest degree, the value of the meat or that this infection is transmissible to man. Likewise, there may be a strictly localized tuberculosis, consisting, for instance, of an isolated tuberculous nodule in the lungs, in the liver, or in some other portion of the body. Such nodule would make the particular point infected "diseased" from the standpoint of meat inspection; in the opinion of some members of the laity, such nodule would also make the entire meat of the animal "diseased" and call for the condemnation of the entire carcass; from the standpoint of meat inspection, the carcass in general would not be "diseased," and there would be no justification in condemning it.

The veterinary inspector, in judging whether a carcass is "diseased," must do so upon the general principles of pathology in its relation to the public health, and not upon any preconceived, exaggerated, or sentimental idea.

The commission would suggest that the cooperation of the public is most valuable in aiding in the suppression of frauds in the meat trade, but that it would be well for the public to have confidence in the ability of the veterinary inspectors to pass judgment upon the purely technical side of the questions involved, since such judgment can be of value only when expressed by persons especially trained for this purpose.

Illustrative of the precautions taken by the Department of Agriculture to safeguard the public health, it is the opinion of the commission that the Bureau of Animal Industry, acting under the existing regulations, would necessarily condemn certain meats which would be allowed, either with or without restrictions, according to circumstances, upon the markets of Germany, France, England, and other countries.

It is only when the disease is slight and localized or circumscribed that the unaffected portions of the carcass are passed for food. Whenever the disease is generalized or disseminated throughout the system, or is of such character or extent as to affect the wholesomeness of the meat, the entire carcass is condemned—and the consumer is given the benefit of every doubt. Careful experiments carried out by the Bureau and by scientists elsewhere have shown that the germs of tuberculosis are not carried in the blood circulation and distributed throughout the system until the disease has reached a very advanced stage. It is therefore considered perfectly safe, when the infection is clearly limited to a certain gland or group of glands or an organ, to remove these parts and pass the healthy parts which have not

[a] One of the most common infections of food animals, especially of hogs. It is due to the presence of a minute parasitic protozoon in the muscles.

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become affected in any way by the disease. The men who pass on these questions are well educated in veterinary science and comparative pathology, and are carefully trained in meat inspection, and hence have special knowledge of animal diseases and their bearing on human health.

It is safe to say that most of the meat which is condemned under the federal inspection would be sold for food if it were not for this inspection. A considerable quantity of diseased and unwholesome uninspected meat is really placed upon the market, as the federal inspection covers but little more than one-half of the total meat supply of the United States. A large part of the remainder receives no inspection whatever, while a small proportion is subjected to some kind of inspection by state or local officers. As pointed out in previous reports, it is important that the States and municipalities should provide an efficient inspection for the meat that is slaughtered and sold locally, and hence is beyond the control of the Federal Government. In some of the States and in quite a number of cities this subject is receiving consideration with a view to inaugurating inspection. An inspection to afford real protection to the health of the public should be made preferably by a competent veterinarian at the time of slaughter, and the places at which meat is slaughtered and prepared for food should be maintained in good sanitary condition.

It often happens that the local authorities must deal with small, scattered, poorly equipped, and very insanitary abattoirs, so that it is difficult and expensive to maintain proper supervision and to enforce proper sanitation. To meet such conditions there should be a central public abattoir where all the slaughtering of the community should be concentrated, and no slaughtering should be permitted elsewhere except at properly equipped places under proper inspection. Such a central abattoir may be under either municipal or private ownership, but in either case it should be under official supervision. The city of Paris, Tex., has erected a municipal abattoir which is in successful operation, and other cities are considering similar action. The Bureau of Animal Industry is endeavoring to assist in such local enterprises by furnishing such information and advice as it can give with regard to the designing, construction, equipment, and operation of public abattoirs, and it is expected that later the Bureau will be prepared to furnish municipal authorities with plans and specifications when desired.

PROPOSED DEPARTMENT OR BUREAU OF PUBLIC HEALTH.

However commendable may be the movement to provide better government facilities for safeguarding and promoting human health, the specific measures which are being urged upon Congress, if carried into effect, would unquestionably be very detrimental to the work which is now being carried on by the Bureau of Animal Industry, and also to the agricultural interests and in some respects to the public welfare.

Several bills are pending in Congress for the establishment of a department or bureau of public health. By one bill it is proposed to establish a new executive department and to transfer to that department not only the Bureau of Animal Industry and certain other branches of the Department of Agriculture, but all matters within the

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control of the Federal Government relating to "diseases of animal life" and all departments and bureaus (excepting those in the War and Navy Departments) "affecting the * * * biological * * * service, or any questions relative thereto." This language is so broad as to cover work relating to plant life, such as forestry, the growing of field crops, fruit culture, etc. To place work of this kind in a department of public health is so preposterous that it is doubtful if the advocates of the measure really intend to do this; yet such is the meaning of the language employed in the bill.

Much of the work of the Bureau of Animal Industry relates to such subjects as the breeding and feeding of live stock and poultry, and dairy practice and methods, including the manufacture of cheese, butter, etc. Obviously, such lines of work have no place in a department or bureau of public health, and their control can not be fairly regarded as in any way essential to the establishment and proper conduct of an efficient public-health organization.

Other bills pending before Congress, not so sweeping in scope, provide for the transfer to the proposed department or bureau of public health of the veterinary work of the Bureau of Animal Industry, including the meat inspection; but such a division and transfer would, in my judgment, seriously impair the efficiency of the service. Experience in this and other countries has shown that work such as the scientific investigation and the eradication of diseases of animals and the meat inspection should not only be performed by veterinarians but should be under veterinary control and direction. It is no reflection upon the medical profession to say that a physician, no matter how capable, is not qualified, without proper veterinary training, to conduct or direct such work.

The Bureau of Animal Industry is essentially an agricultural organization and deals primarily with agriculture, and its logical place is in the Department of Agriculture, even though some branches of its work have an important bearing on the public health. Even in the portions of the Bureau's work of which the protection of human health is an important object, the problems are mainly agricultural and must be attacked from the agricultural side.

The production and conservation of the public food supply are of the highest importance to human health, but the measures by which such production and conservation are accomplished are mainly agricultural. In other words, while the end is a matter of public health, the means of accomplishing that end constitute an agricultural problem; and the Department of Agriculture is certainly the most appropriate agency for carrying out such agricultural means. To maintain an adequate supply of food-producing animals to meet the needs of the people, not only must methods of breeding and feeding live stock be studied and applied, but diseases of animals must be studied and combated; and all this work is an integral part of one great problem and should not be divided.

The large amounts expended by the Government for the protection of the health of live stock are sometimes contrasted with the small appropriations for protecting and promoting the health of the people. Such comparisons are fallacious and misleading. The money appropriated by Congress for the work of the Bureau of Animal Industry is not appropriated because of any sentimental feeling for the welfare of the animals themselves, but the real object is to provide a

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sufficient and wholesome supply of food for the preservation of human life and health.

In the interest of economy and good administration it is important that the work of the Bureau of Animal Industry should remain intact and in the Department of Agriculture. It is folly to argue that the consolidation of the various government agencies having a bearing in any way on the public health into one organization would be a measure of financial economy. If this Bureau were removed from the Department of Agriculture, it would be essential for that Department to replace a large part of the organization if it continued to deal efficiently with agriculture, and this would duplicate and increase expenses instead of reducing them. The present organization permits the use of the same men (under various appropriations) in different lines of work and their transfer from time to time to meet the needs of the service—an arrangement that would not be possible if the work were divided by the transfer of the meat inspection to the proposed new organization. As pointed out in my report for the preceding year, the field work in eradicating diseases of animals is mostly done during the summer, while the work of slaughterhouses is heaviest during the winter; and a number of men can be utilized for field work in the summer and for meat inspection in the winter, thus effecting an economy which would not be possible if these lines of work were not under the same management. A striking illustration of the advantage of the present organization was given in that report with reference to the outbreak of contagious foot-and-mouth disease in the winter of 1908, when it was possible to draw immediately on a trained force of veterinarians and scientists already engaged in the meat inspection and other regular work of the Bureau. Had these branches been separated, the contagion would very probably have spread widely and reached the great stock-raising regions of the West before a force could have been organized to combat it, and there it would have caused tremendous damage and loss and its eradication would have been exceedingly difficult and expensive if not impossible.

It seems that it should be entirely possible and practicable for the Government to enlarge its work for human health and to maintain an efficient public-health organization without placing under that organization work which has no logical place there and without impairing existing branches of the government service with no corresponding benefit to the public.

STUDY AND ERADICATION OF CONTAGIOUS DISEASES OF ANIMALS.

The scientific investigation of various animal diseases has been continued, and the policy of having such diseases studied in the field by a larger number of experts than heretofore has been adopted. The work for the eradication of certain contagious diseases has been unusually effective during the past year.

ERADICATION OF CATTLE TICKS.

With the steady extension of the zone affected by the ravages of the cotton-boll weevil, and the growing realization by southern farmers of the need of giving more attention to stock raising, the

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value of the work being done for the extermination of cattle ticks becomes more apparent and the people of the tick-infested territory are showing greater interest in this undertaking. Much has been done in the way of developing the hog, sheep, and poultry industries in the South and the introduction and breeding of a better class of animals, and hog raising especially has been demonstrated to be successful and profitable there; but the important industries of cattle raising and dairying can never be brought to a high degree of success as long as the South remains under the heavy handicap of the cattle tick. These ticks not only keep the cattle in poor condition, but spread the infection of the disease known as Texas fever, which makes it necessary to quarantine the cattle of tick-infested regions and to allow them to be marketed only under certain restrictions which lower their selling price. The presence of the ticks also makes it impracticable to introduce a better class of cattle from noninfected sections.

For the past four years the United States Department of Agriculture, through the Bureau of Animal Industry, has been engaged in cooperation with state and local authorities in an effort to exterminate these ticks; and although this is a difficult undertaking, which will require many years for its successful conclusion, the progress so far made has already brought great benefits to the portions of the territory that have been freed from the ticks and has demonstrated that it is practicable in time to eradicate the ticks from the infested region. During the past fiscal year there have been released from quarantine as a result of the eradication of these ticks 57,518 square miles of territory, which is the largest area released in any year since the beginning of the work in the summer of 1906. The total area so released since the beginning of the work amounts to 129,611 square miles.

The rapidity with which this work can be carried forward depends on the amounts of money appropriated by the federal and state governments and upon the cooperation of the people of the affected region. The federal appropriation for the past fiscal year was $250,000, and a like amount has been appropriated for the succeeding year. In order to use this money to the best advantage, the policy of the Department is to operate only where state and local authorities are prepared to offer substantial cooperation and where public sentiment is favorable. During the calendar year 1909 the States and counties expended about $130,000 in this work, as indicated by reports received by the Bureau; and as the work advances and its benefits become more obvious there is a disposition to increase the appropriations from year to year.

Besides the field work in exterminating the ticks by such methods as dipping, spraying, hand treatment, and pasture rotation, the Bureau has continued the dissemination of information as to the nature of the ticks and the disease which they spread and as to advantages and methods of getting rid of them. Literature has been distributed, material has been furnished to newspapers, and lectures and addresses have been given at farmers' institutes and other meetings. A Farmers' Bulletin on "Methods of Exterminating the Texas-Fever Tick" was issued during the fiscal year and has been extensively distributed.

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LIP-AND-LEG ULCERATION OF SHEEP.

The form of necrobacillosis known as lip-and-leg ulceration of sheep, which appeared in Wyoming about two years ago and became so threatening as to necessitate a federal quarantine in the early part of the past fiscal year, has fortunately become much less prevalent under the quarantine and methods of treatment carried out under the direction and cooperation of federal and state officers, aided, perhaps, by the drought of the past season. This disease appeared in a very malignant form over a large part of Wyoming and Montana, and it was necessary, before progress could be made in controlling it, to study more closely its nature and to work out methods of treatment. During the fall, winter, and spring three meetings were held at which officers of the Bureau conferred with officers and sheep owners of the affected States to discuss the situation and consider means of dealing with it. A circular describing the disease and recommending methods of treatment was issued in the spring and has been widely circulated in the affected region. Ten veterinarians of the Bureau's staff were stationed in different parts of Wyoming to observe the disease and to instruct and assist the flock masters in the best methods of treatment and in the disinfection of infected premises. Where care was exercised in administering the treatment and in disinfecting the premises the disease either disappeared or was greatly reduced. About one-fourth of the area placed under quarantine in the early part of the fiscal year was recently released, and the number of cases of the disease in the territory remaining in quarantine has been reduced about 50 or 75 per cent.

It has been thoroughly demonstrated that this disease can be controlled by methods such as have been adopted, although the malignant form is persistent, and very careful and thorough treatment is necessary. Numerous instances were found where flocks had become infected by being permitted to trail over ranges where diseased sheep had been and to drink at water holes where such sheep had watered. These instances, considered in connection with scientific experiments made by the Bureau, show beyond question that the disease is of a contagious nature. While the majority of cases are of a mild type affecting only the lips, it seems that under certain conditions, which are not at present understood, this type may develop into the more severe form. In order to stamp out the disease, it is therefore necessary to treat the mild as well as the malignant form.

SCABIES OF SHEEP AND CATTLE.

The eradication of scabies of sheep in the West has progressed so well that during the fiscal year areas aggregating 390,000 square miles were released from quarantine and the disease was greatly reduced in the territory remaining under quarantine.

During the fiscal year, owing to the continued increase of scabies in sheep in the State of Kentucky, the entire State was placed under federal quarantine. On account of the absence of an efficient state law under which the Bureau could cooperate, no active work in the eradication of the disease has been done. However, at the last session of the Kentucky legislature an act was passed providing for the appointment of a state live-stock sanitary board with power to

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control and eradicate infectious and contagious diseases of live stock. Such a board was appointed June 15, 1910, the day after the law became effective. Arrangements have been made for the Bureau to cooperate with this board in eradicating sheep scabies, and to this end active work will be commenced in the near future.

The area quarantined for scabies of cattle in the West was reduced during the fiscal year by the release from quarantine of more than 50,000 square miles.

ERADICATION OF BOVINE TUBERCULOSIS IN THE DISTRICT OF COLUMBIA.

During the past few years there has been a continuous and marked increase in private and legislative efforts to eradicate bovine tuberculosis. Coincident with these efforts on the part of States and municipalities, the Bureau of Animal Industry has given active aid toward the eradication of the disease in a number of localities and in preventing the interstate movement of cattle affected with tuberculosis. In the belief that a demonstration of the practicability of eradicating bovine tuberculosis from a given area would be of material benefit by the encouragement which it would give and by outlining working methods to accomplish successful results, the District of Columbia was selected for the purpose, and a cooperative arrangement was entered into with the Commissioners of the District.

All the cattle in the District, numbering 1,701, were tested with tuberculin, and of these 321, or 18.87 per cent, gave reactions. All of the reacting animals were slaughtered under inspection, and all except a few belonging to the Government were appraised and the owners reimbursed. In only five of the carcasses was there a failure to find lesions of tuberculosis on post-mortem, hence the correctness of the tuberculin reaction was verified in 98.36 per cent of the cases. Of course there is a likelihood that in these five cases the lesions were present but were too minute for detection by the methods used. In nearly 77 per cent of the carcasses the lesions were so slight and localized as to permit the use of the meat for food, while the remainder were more or less generalized cases and were entirely condemned. The average appraised value of the reacting cattle was $45.41. An average price of $18.88 was obtained from their sale, and the Department reimbursed the owners to the extent of an average of $13.97 for each animal, making the average loss to owners $12.56 per cow, based upon the appraised value. The particulars of this work are given in the portion of this report relating to the Quarantine Division.

GID IN SHEEP.

Since the discovery of the gid parasite in sheep in Montana was announced by the Bureau a few years ago the study of the gid disease and the parasite which causes it has been continued. One publication giving some of the results of this work was issued during the year and others are now in press and in preparation. As the disease appears to be prevalent only in a part of Montana, it is very desirable that the parasite should be prevented from spreading to other sections and that it should be exterminated if possible. To that end the Bureau is endeavoring to place before the sheep owners of the affected region correct information as to the life history of the parasite, the nature of the disease, and methods to be followed in combating the parasite.

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BREEDING HORSES FOR THE UNITED STATES ARMY.

Although horses are now commanding higher prices than have been known for many years, there is evidently a great shortage in their production. The United States Army has for some years found it difficult to maintain an adequate supply of suitable horses, and it seems that if the efficiency of the cavalry is to be maintained it will be necessary for the Government to take up some systematic plan to encourage the breeding of horses of a type suitable for army use.

During the past year the Secretary of War requested the cooperation of the Secretary of Agriculture in evolving some plan for enabling the army to obtain suitable horses. The Secretary of War pointed out that the supply of horses fit for remounts is becoming more and more limited, and that the present indications are that the country would find it impossible to mount its army from its own resources in time of war and is rapidly reaching a point where the needed supply of suitable remounts for the present strength of the army would be extremely difficult to obtain, if obtainable at all. As a result this Department designated a representative to join with a representative of the War Department in considering the subject and formulating a plan. The Department of Agriculture was represented by Mr. George M. Rommel, Chief of the Animal Husbandry Division of this Bureau, and the War Department by Capt. Casper H. Conrad, jr., Third Cavalry, U. S. Army, detailed for duty in the Quartermaster-General's Department in connection with the purchase of remounts. These gentlemen have outlined a plan for breeding horses for army use, which plan is presented in the portion of this report dealing with the work of the Animal Husbandry Division. To carry out this plan would require appropriations for the use of this Department estimated at $250,000 for the first year and $100,000 a year thereafter.

NEW EXPERIMENTAL FARM.

For several years the Bureau has felt the need of a farm near Washington on which it could conduct experiments and investigations in breeding and feeding animals and in dairying, so that such work could be kept separate from that relating to infectious diseases as carried on at the Experiment Station at Bethesda, Md., as the work is so entirely different in character and is under the supervision of different divisions of the Bureau. In the appropriation act for the Department of Agriculture for the fiscal year ending June 30, 1911, Congress appropriated $25,000 for the purchase of such a farm. The Department purchased a farm of about 475 acres located at Beltsville, Prince George County, Md., about 13 miles from Washington. This farm is now being equipped for the purpose in view, and will be used by the Dairy and Animal Husbandry divisions of the Bureau. The work in the breeding and feeding of animals and poultry heretofore carried on at the Bethesda Experiment Station will be transferred to the new farm, and dairy work will be taken up later. The experimental work relating to diseases of animals will be conducted as heretofore at the Bethesda station.

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NEED FOR ANOTHER ANIMAL QUARANTINE STATION ON THE ATLANTIC SEABOARD.

In recent years there has been a great increase in the number of imported animals subject to quarantine, and the capacity of the quarantine stations near the ports of New York and Boston has been overtaxed. This has caused considerable inconvenience to importers, some of whom have been compelled to defer shipments awaiting the release from quarantine of other importations before space could be found for their importations. A number of them have diverted their animals to the Canadian quarantine station at Quebec.

There is great need for an additional quarantine station on the Atlantic seaboard, and this station should be located directly on the water front so as to be specially adapted to the reception of animals in cases where there seems to be more than ordinary danger of carrying infection. At the present time the Bureau has no quarantine station on the water front. At New York transportation by barge from the steamer to the railroad on the New Jersey side is necessary, in addition to which 16 miles must be covered by rail before reaching the Athenia station. The quarantine of animals entering at Boston requires a railroad shipment of about 30 miles to reach the Littleton station.

As many importers have expressed their preference for the port of Baltimore as a quarantine station, on account of its being farther south than Boston or New York, thus having a milder climate, it is evident that if a quarantine station could be located on the water front near Baltimore, so that animals could be delivered by barge directly at the station from the steamer, such a station would not only receive its full share of patronage but would increase the number of fine breeding animals imported into the United States, and would diminish the danger of the introduction and spread of contagious diseases.

NEEDED LEGISLATION.

SUPERVISION OF VACCINES, SERUMS, ETC.

In my report for the preceding year attention was called to the importance of investing the Secretary of Agriculture with legal power to control the importation of vaccines, serums, antitoxins, tuberculins, and other preparations sold for the detection, prevention, or treatment of diseases of animals, and to supervise the preparation of such products manufactured in this country for interstate commerce, such authority to be similar to that already vested in the United States Public Health and Marine-Hospital Service with regard to such products used in human medicine. A bill for this purpose was introduced in Congress but was not acted upon at the last session. With the growing use of these remedies in veterinary medicine there is constant and increasing danger that contagious diseases may be introduced from abroad and spread in this country through such preparations unless their importation is properly supervised, and the facts reported last year show the necessity for the supervision of domestic preparations of this kind in order to protect our farmers, stock raisers, and veterinarians against fraudulent and unreliable preparations.

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TRANSPORTATION OF LIVE STOCK.

Additional legislation by Congress is needed to enable the Department to regulate more effectively the interstate transportation of live stock so as to prevent the spread of contagious diseases and provide more humane conditions.

Experience in the enforcement of what is known as the twenty-eight-hour law has shown the desirability of exempting from its operation live stock which is being shipped under quarantine restrictions. Owing to unforeseen delays it is sometimes necessary in order to comply with the law to unload stock which is being shipped under quarantine restrictions into pens which are not specially set apart for that class of stock and which are likely to be used soon afterwards for other stock, and in this way infection has sometimes been spread. This danger could be practically obviated if the Secretary of Agriculture were clothed with power in such cases of emergency to waive the provisions of the law so that animals under quarantine might be kept in the cars for a sufficient time to reach a point where facilities were available for handling them without danger to other stock.

Although existing law authorizes the Secretary of Agriculture to require the disinfection of live-stock cars moving into or out of a section that is quarantined, it is desirable to have this authority extended so as to empower the Secretary of Agriculture to require the disinfection of any live-stock cars used in interstate commerce whenever he may consider such disinfection necessary in order to prevent the spread of disease.

In the shipment of live stock it is sometimes a practice to put into the same car animals of various sizes and different species, with the result that small animals are often injured or trampled to death by larger ones. In order to remedy this evil it is desirable that the Secretary of Agriculture should have authority to regulate the shipment of different classes of stock in the same cars.

Dead animals are sometimes shipped in the same cars with live ones, and there is danger of the spread of disease in this way. Such shipments should be prohibited by law.

INTERSTATE SHIPMENT OF DAIRY PRODUCTS.

In my previous reports attention has been called to the need for inspecting dairy products and supervising their shipment. Cream is shipped great distances to creameries to be made into butter, and it is often received in such a filthy and putrid state as to be utterly unfit to enter into the composition of a food product. Even though Congress may not be ready to establish a comprehensive system of inspection for dairy products, much good could be accomplished by a law regulating the interstate shipment of cream and other dairy products so as to prevent interstate traffic in unwholesome products.

RENOVATED BUTTER.

At present the Bureau of Animal Industry supervises the manufacture of what is known as renovated or process butter and maintains inspection at the factories where it is prepared. This law has been found inadequate in some respects, and I consider it desirable to have

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it amended or superseded by a law containing provisions similar to those of the meat-inspection law, so far as they may be applicable, but retaining the revenue feature of the present law.

VETERINARY EDUCATION.

As stated in my last report, the courses of instruction in the various veterinary colleges in the United States were investigated by two committees, and certain recommendations as to requirements for admission to the civil-service examination for veterinary positions in the Bureau were approved by the Secretary of Agriculture and the United States Civil Service Commission to take effect September 1, 1909. Most of the colleges have been disposed to meet the requirements of the regulations in order that their graduates may be eligible to the Bureau service, and there has already been considerable improvement in the courses and facilities at these colleges. The result is that not only is it possible for the Bureau to obtain men better educated and qualified for its veterinary work, but the standard of veterinary education in the United States is being elevated.

PUBLICATIONS AND DIFFUSION OF INFORMATION.

The results of the Bureau's work are made available to the people through publications, correspondence, public addresses, and material furnished to teachers, writers, and the press.

The Bureau's new publications issued during the fiscal year numbered 89, aggregating 1,970 printed pages, besides which there were numerous reprints of earlier publications. The new publications consisted of the Twenty-fifth Annual Report of the Bureau (for 1908), the annual report of the Chief of the Bureau for the fiscal year 1909, 12 bulletins, 15 circulars, 2 Farmers' Bulletins, 10 reprints from the annual report, 2 Yearbook articles, 29 orders and amendments, and 17 miscellaneous publications.

In addition to the distribution of literature it is necessary to conduct a heavy correspondence to meet the large volume of requests for information.

THE ANIMAL HUSBANDRY DIVISION.

The Animal Husbandry Office of the Bureau was designated as the Animal Husbandry Division after January 1, 1910, by order of the Secretary of Agriculture. The work of the division is in no essential manner different from that of the Animal Husbandry Office. Mr. George M. Rommel has all along been in charge of this work, as Animal Husbandman during the first half of the fiscal year and as Chief of the Animal Husbandry Division since the establishment of that division.

HORSE BREEDING.

COLORADO WORK.

The work in carriage-horse breeding at the Colorado Experiment Station has been much more satisfactory than during the previous year. There was no serious loss at foaling time and the foals are a

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very satisfactory lot. The foals by the stallion Carmon out of the mares purchased in Kentucky in 1908 are especially good.

The board of survey condemned 12 animals in August, 1909, all of which were removed from the stud. Two were destroyed (one for unsoundness and one for injuries) and the remainder sold. The mare Arba was injured in the pasture by cutting the tendons of the right hind leg just above the fetlock, and she was also destroyed. There were in the stud on June 30, 1910, 5 stallions in service, 31 brood mares, and 35 young animals; a total of 71.

A 2-year-old colt by the well-known Standardbred carriage stallion, Sir Walkill, jr., 32695, was bought in June, 1910, in Cedar County, Iowa, and will be given a trial at the stud. He is a very good individual and promises to develop into a good sire. He will not be available to outside mares until he has been given a thorough trial.

VERMONT WORK.

The work at the Morgan Horse Farm, Middlebury, Vt., is progressing satisfactorily, and each successive year's foals by General Gates show the wisdom of his purchase as the leading sire. The foals of 1909 (now yearlings) are a splendid lot and those of 1910 are equally promising. The only logical criticism which has ever been made of General Gates is that the Thoroughbred cross close up in his pedigree would make his get uncertain breeders. The use of Red Oak, a stallion sired by General Gates, is showing this criticism to have no foundation. Although Red Oak has not had severe service, he has produced a uniformly good lot of foals of a uniform Morgan type.

Purchases during the year were the brood mare Caroline by Daniel Lambert, and a yearling filly out of Caroline by General Gates. Caroline is the dam of Shakespeare, grand champion Morgan stallion at the St. Louis World's Fair; of Carrie Gates, first prize 2-year-old filly at the same show; and of Helen, one of the most promising young mares at the Morgan Horse Farm. Caroline is now about 24 years of age and is still producing.

Three yearlings were disposed of at the close of the year and further culling will be done in the near future, some of the older stock being unsatisfactory for breeding purposes.

The following horses were in the stud on June 30, 1910: Stallions, 3; brood mares, 13; young animals, 14; total, 30.

CLASSIFICATION FOR AMERICAN CARRIAGE HORSES.

The classification for American carriage horses recommended by the Bureau in cooperation with the American Association of Trotting Horse Breeders has received a general acceptance by state fairs throughout the Central West. The showing of 1909 was more satisfactory than that of 1908, and considerably more interest was manifested by horse owners. The classification promises to become a permanent feature of state fair premium lists.

SHEEP AND GOAT INVESTIGATIONS.

The work in range sheep breeding was continued during the fiscal year in cooperation with the Wyoming Experiment Station, but it has been found desirable for the Department to carry on the work

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independently, and the arrangement with the station has been terminated. The experiment will not be removed from the State of Wyoming.

The methods of breeding have not been changed. Ewes that are short in fleece are bred to a Delaine ram, which shears a 3-inch staple. Ewes with folds or wrinkles on the neck are bred to a smooth-skinned ram in order to produce lambs that will be smoother than their dams. Ewes not especially well covered over the head and legs are bred to a ram especially good in this respect. Small ewes are bred to one of the largest rams. Ewes which show a tendency to coarseness of fleece are bred to a very fine-fleeced ram.

The lambing season the past spring was one of the best which we have yet had. Two hundred and eighty-three lambs were dropped, 149 ewe lambs and 134 ram lambs. At the time of sending the ewes and lambs to the range there were 243 lambs. Owing to the fact that we have had two very poor crops of lambs, which was due largely to the severe weather at lambing time on the range, it was decided last winter to bring the ewes in to the experiment station for lambing. This was done last spring, and the good lamb crop was the result.

The breeding ewes averaged 105 pounds in weight at shearing time, and sheared an average of 10.6 pounds of wool. The yearling ewes weighed an average of 73.8 pounds and sheared 7.31 pounds. The rams sheared an average of 14.2 pounds per head. The wool was graded as follows: Twenty-six fleeces as fine, 240 fine medium, 79 medium, and 1 low medium. The ram fleeces were graded as 1 fine, 2 medium, and 5 fine medium. The condition of the wool was given as follows: Sixty-two fleeces were in poor condition, 2 in very poor condition, 139 in fair condition, and 129 in good condition. The fleeces of the ewes averaged 2.27 inches in length.

Ever since the acquisition of the Morgan Horse Farm the idea has been kept in mind that a flock of sheep should be maintained there for their beneficial effect on the land, but principally to encourage New England farmers to return to sheep raising. A few head of registered Southdowns have been kept for some time, and last fall 30 ewes and a buck were purchased from one of the best flocks in Canada. An old barn has been rebuilt for a sheep barn and a shepherd engaged. Rams will be sold during the early fall after they are 1 year old, and every effort made to assist in building up the sheep industry of New England. Last spring 32 ewes dropped 43 lambs.

The flock of sheep at the Bureau Experiment Station at Bethesda, Md., comprises 21 head of Delaine Merinos, 50 Barbados, 8 crossbred Merino-Barbados, and 4 the progeny of crossbreds. The Delaine Merinos will be used for some wool experiments during the coming year. A number of Barbados ewes will be bred to a Southdown ram for the production of early lambs. Owing to the fact that these ewes are especially good milkers and will breed any time of the year, it seems that they should be valuable for crossing with mutton rams for the production of early lambs.

At the present time the Bureau has a flock of 38 milch goats—22 old does, 5 yearling does, 8 kids, and 3 bucks. During the past kidding season we have not had very good results with the goats, as 26 of the 33 kids dropped had goiter. At the close of the fiscal year 18 does were being milked, and samples of the milk were being tested for butter fat and subjected to chemical analysis.

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CATTLE BREEDING.

HOLSTEIN CATTLE.

A field superintendent for the Holstein cattle work in cooperation with the North Dakota Experiment Station began work November 15, 1909, the first work undertaken being to test all the cattle in the herd of each member of the circuit for tuberculosis. Only four head reacted in 400 tested. Two head of the four reactors were purebreds that had been brought in from other States for the circuit work and had been bought subject to the test. The other two were grades that had been in the herds some time.

On January 1 arrangements were made for keeping the record of milk and fat produced by each cow on the circuit. The milk of each cow is weighed at each milking, and the field superintendent visits each farmer once a month and makes a fat test of the milk of each cow. The cost of the feed is also being determined as closely as possible.

The breeding, feeding, and general care of the cattle in the herds are closely watched, and the superintendent gives advice on these points during his monthly visits.

Several meetings of the members of the circuit association were held during the year for instruction in better methods of feeding and management. The use of silos is being especially emphasized. Members of the experiment station staff have assisted at these meetings. The members of the circuit and farmers of the surrounding country and of the State as a whole have taken a great deal of interest in the work of the circuit. The purebred Holsteins of all ages in the circuit number 71 head.

In the near future it is expected to test some of the promising cows and heifers for the advance registry of the Holstein-Friesian Breeders' Association. The herds will be carefully culled during the year and the culls replaced with new purchases.

MILKING SHORTHORNS.

There are now four herds in the circuit for the breeding of milking Shorthorn cattle in cooperation with the Minnesota Experiment Station. During the year one herd was dropped from the circuit, and one herd was added. The feeding and general management of the herds has been materially improved, and more careful records have been kept. Two of the cooperators are now putting up silos.

The two sires, Chief of Glenside 285899 and Beau of Glenside 285898, are now past 3 years old. In addition to what is known of the general high standard of the milking heredity of these bulls, their value from this standpoint has been much enhanced during the past year by the record of 18,000 pounds of milk and 735 pounds of butter made by Rose of Glenside, the dam of Chief of Glenside and the half-sister of Beau of Glenside. These bulls are now being used entirely on the circuit. They have sired several yearlings and about 20 calves dropped in the fall of 1909 and spring of 1910. These are a thrifty, rugged lot and give promise of growing into very good cattle.

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All heifers produced by approved dams will be reared to maturity, when they will be tried out at the pail. Their milk production in connection with their general conformation and breeding power will then determine their value to the project. The bull calves are being reared, and at 8 to 12 months old will be divided into three classes—reserved, approved, and rejected. All bull calves rejected will be sold for slaughter, those approved will be sold to breeders in the usual way, and those reserved will be kept for use on the circuit.

The cows on the circuit are largely the same as last year except some heifers that have matured and a few cows that were purchased in the East. Four cows purchased in New York and Pennsylvania have been added to the experiment station herd.

Three heifers of the same breeding have also recently been purchased for one of the herds in the circuit. They are all in their first period of lactation and give indications of proving to be good producers.

During the past year there has been much inquiry and a rapidly increased demand for Shorthorns that will milk profitably. The cooperators have had no females and few bulls to sell. The majority of buyers are demanding milk records and apparently becoming more discriminating in their selection of breeding animals.

ANIMAL BREEDING INVESTIGATIONS.

During the past year the breeding experiments which have been under way at the Bureau Experiment Station at Bethesda, Md., were continued and valuable data are being obtained.

The results of the zebra hybrid breeding work have been fully described in an article submitted for publication in the Twenty-sixth Annual Report of the Bureau.

The inbreeding experiments are making satisfactory progress. Data have been obtained from about 5,000 guinea pigs during the past year. Complete results of the work can not be reported until later. A race of polydactylous guinea pigs has been established by selecting sports having this peculiarity for foundation stock.

The results obtained from the rat-breeding work have verified Mendel's law of heredity so far as coat color is concerned.

POULTRY INVESTIGATIONS.

MAINE WORK.

The detailed intensive study of inheritance of egg production or fecundity in the domestic fowl in cooperation with the Maine Experiment Station has gone forward satisfactorily during the year. By the plan of selection now being practiced it has been possible to isolate from the flock strains or "blood lines" which are breeding true to definite standards of egg production. There are now being propagated (*a*) lines having a high winter egg production, (*b*) lines having a medium degree of winter productiveness, and (*c*) lines of low winter production. The results which have been obtained in this work are of a definite character and are believed to be of fundamental significance, not only in relation to breeding for egg production, but also in relation to the broader problem of breeding animals for

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production in general, whether of meat, milk, or other desirable qualities.

The experiment in breeding hybrid poultry from Barred Plymouth Rocks and Cornish Indian Games is progressing well. By the application of the Mendelian principles it has been possible to combine in one strain the good meat quality of the Cornish Indian Game with the good laying quality of the Barred Plymouth Rock. The new type thus created seems to be a very desirable one from the utility standpoint. The study of egg production of these hybrids has resulted in bringing to light important evidence regarding a type of inheritance—sex limited—hitherto but little understood.

In connection with the work in breeding for egg production a detailed study of factors influencing the fertility and hatching quality of eggs has been made, which shows that this quality is a definitely inherited character which may be improved by selective breeding.

In general the plans for the future contemplate a continuance and further development of the work already under way.

INDEPENDENT INVESTIGATIONS.

During the year the poultry investigations at the Bureau Experiment Station have been continued. The comparison of the dry and moist mash and the hopper systems of feeding, begun in the fall of 1906, were brought to a close in the fall of 1909. This work has been carried through the three years, and three successive generations of fowls have been used. The results have been so variable that no definite relation between egg yield and method of feeding has been established.

During the year a feeding test was begun with cotton-seed meal to see whether it had any harmful effect on laying hens. Five pens of fowls were used in this test. In addition to a grain ration, which each pen received, there was fed to one pen a mash containing about 30 per cent of cotton-seed meal, and to another a mash containing about 18 per cent; and there were fed to the other pens, as checks, mash containing from 12 per cent to 40 per cent of linseed meal. The mash containing 30 per cent cotton-seed meal was as rich a cotton-seed mixture as the hens would eat readily. This experiment has been running six months and no harmful effects which can be attributed to the cotton-seed meal in the ration have been noted.

A short experiment to determine the palatability of soy beans and cowpeas as a feed for laying hens was carried on. Three pens were used, each receiving in addition to their mash a grain feed composed in the check pen of equal parts of wheat and whole corn, and in the other pens cowpeas and soy beans in place of the wheat. After a few days both the cowpeas and the soy beans were eaten readily and apparently relished. The hens seemed to do quite as well on the cowpeas or the soy beans as on the ration containing wheat.

During the winter dried beet pulp was tried to some extent as a green feed. This material furnished a green feed which seemed to be quite palatable, cheap, and generally satisfactory.

The work at Bethesda has been greatly handicapped by the reappearance in the flock of coccidiosis or white diarrhea, the disease which caused so much trouble last year. This has rendered it impossible to rear satisfactory young stock, those escaping death being

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stunted and entirely unfit to save for breeding purposes. The effect of the infection is also apparent in the old stock, causing an abnormally high rate of mortality, greatly reducing the vigor and the egg yield.

During the year plans have been perfected for following up the investigation of the methods of handling eggs. A preliminary survey of this field had previously been made, and the information thus obtained is to be followed up by field work. The plans contemplate the prosecution of this problem by this Bureau in cooperation with the Bureau of Chemistry. The source of production of the eggs, methods of feeding the hens, conditions under which the eggs are produced, and the various steps and conditions in the handling of the eggs till they reach the packing house will be studied by this Bureau. From that point onward, through cold storage or without it, to the ultimate consumer, the eggs will be followed by the Bureau of Chemistry. There is good ground for the belief that an investigation of this character will result in a cutting down of much of the present waste and deterioration due to careless or ignorant methods and will eventually mean a greater return to the producer and a better average quality of eggs produced in the summer and fall months without added cost to the consumer.

ANIMAL NUTRITION.

The experiments in cooperation with the Pennsylvania State College have been conducted during the past fiscal year for the purpose of ascertaining the feeding value of hominy feed, a by-product of the manufacture of hominy from corn, concerning which little accurate information is available. A comparison was made of this feed with the corn from which it was manufactured, and incidentally the energy values of mixed clover and timothy hay were also included in the investigation.

BEEF PRODUCTION INVESTIGATIONS.

Investigations in beef production have been in progress for six years in cooperation with the Alabama Experiment Station, and results are being obtained which indicate not only that cattle may be profitably fed in the South, but that the South offers an excellent field for the extension of the beef-producing area of the country. During recent years these investigations have been confined to Sumter County, and the work has been done under the supervision of Prof. Dan T. Gray, of the Alabama Experiment Station, directly with farmers who furnish the cattle, the feed and pasture, and all buildings and equipment. The Department and the Alabama Experiment Station furnish the men to carry on the work. One assistant has been stationed at each farm, who usually selects the cattle and feeds them.

Until the last fiscal year this work was done with only one cooperator on two farms, but last year another cooperator was added in the same county.

The following questions are being studied: Methods of carrying mature beef animals through the winter months with the object of fattening them on pasture the following summer; methods of carrying calves through the winter months with the object of finishing them the following summer or fall; to determine the profit, if any, in

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supplementing the summer pasturage with certain cotton by-products in finishing cattle for the summer or fall markets; to determine the most profitable amount of cotton-seed cake to feed steers where they are being finished on pasture for the market; to compare silage, cotton-seed hulls, and Johnson-grass hay as feeds for finishing steers in winter time; to determine the value to the soil, as measured by succeeding cotton crops, of feeding cattle upon that soil.

Results, so far as the work has progressed, have been prepared for publication. They show that while winter feeding may be sometimes done fairly economically, summer feeding on grass has been found most profitable. For example, during the summer of 1909 cattle were fed on pasture alone, at a cost of $1.03 per hundred pounds gain, on pasture and cotton-seed cake at a cost of $3.21 per hundred pounds gain, and on pasture and cotton seed at a cost of $2.39 per hundred pounds gain, the profit per steer on these lots being $7.06, $6.99, and $8.39, respectively. A lot fed a shorter time on a ration of cotton-seed cake considerably heavier than that noted above cost $2.70 per hundred pounds of gain, with a profit of $10.64 per head.

When it is considered that these profits were made by feeding the cattle alone, without hogs to follow the steers, it is apparent that there is an undoubted future before the beef-cattle industry in the South. There are large areas in the South well adapted to profitable beef production and where no cattle are now fed. There are therefore great possibilities before the South to add to a beef supply that is rapidly decreasing in relative if not in actual ratio to the country's increase in population.

During the fiscal year 1911 an investigation will be made into the problems underlying the shrinkage of beef cattle in shipment, both from the range and from the corn belt.

PORK PRODUCTION INVESTIGATIONS.

During the fiscal year just ended studies in pork production were established at one of the farms in Sumter County, Ala., where beef work is in progress. The object of this work is to carry out, under farm conditions, some of the conclusions that have already been drawn by the Alabama Experiment Station, and to determine the profits that can be realized upon a herd of hogs when fed and handled in a businesslike manner. In doing the work a complete record is kept of the expense of making the various forage crops, the amount of concentrated feeds given all hogs, the gain in weight, etc. In July, 1910, there were 138 hogs in the test. This number will be increased as time goes on. Purebred boars are being used with ordinary sows.

SUPERVISION OF PEDIGREE RECORD ASSOCIATIONS.

The investigation of the draft-horse stud book, referred to in my last report, was completed during the year, and the society publishing the book was given two hearings before the Department. In general it may be said that as a result of the conditions disclosed by this investigation it has become necessary for the Department to exercise the power given to it by the tariff law to pass upon the sufficiency of the pedigree certificates of animals imported for breeding purposes,

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instead of delegating this function to certified American pedigree record associations, as has been the policy heretofore.

There were on the Department's list of certified pedigree record associations at the close of the fiscal year 135 books of record, of which 66 were American and 69 foreign.

BREEDING HORSES FOR THE UNITED STATES ARMY.

The question of breeding horses for the United States Army has been discussed briefly in a previous portion of this report. The following discussion, presenting more in detail the difficulty of obtaining suitable horses for army use, the great need of government encouragement of breeding such horses, and a definite plan for accomplishing the desired object, is the result of the joint consideration of the subject by representatives of the Department of Agriculture and the War Department at the instance of the Secretary of War. As before stated, the Department of Agriculture was represented by Mr. George M. Rommel, Chief of the Animal Husbandry Division of the Bureau of Animal Industry, and the War Department by Capt. Casper H. Conrad, jr., Third Cavalry, U. S. Army, detailed for duty in the Quartermaster-General's Department in connection with the purchase of remounts. The statement setting forth the reasons why the War Department regards it as imperative for the Government to undertake the work of encouraging the breeding of horses for the army was prepared by Captain Conrad and is inserted here with the consent and approval of the Quartermaster-General. The plan for breeding the horses was prepared by Mr. Rommel with the assistance of Captain Conrad and other officers of the army stationed in Washington, and has been formally approved by the War Department.

THE NECESSITY FOR GOVERNMENT ENCOURAGEMENT OF BREEDING ARMY HORSES.

The difficulty experienced by the Quartermaster's Department in procuring remounts seems perfectly natural. The early settlement of the United States, particularly the eastern part, went on some time before the advent of steam and electric transportation, and the settlement of the western part even now in the most remote points takes place without the assistance of modern transportation. In all new countries the horse has played an important part in the advancement of civilization and the general scheme of settlement. Even in the first part of the nineteenth century the horse was a very much more important animal in Europe and the British Isles than at present.

During the opening of a country the settler must, owing to the absence of roads and other forms of transportation, put his principal reliance upon the horse; he is forced to travel trails and long distances, and for this purpose finds that he needs a horse suitable to carry him quickly and comfortably to his destination. To accompany him and carry the articles necessary for his daily life, he needs a pack animal. So long as conditions remain unchanged, a desirable type of saddle and pack animal will exist in good numbers; but so soon as the country becomes more settled and habitations more permanent, the mountain trail gives place to the road, and later the country road to the worked and metaled highway, and the type of horse rapidly changes. The necessity for the saddle animal lessens; the light-draft

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animal becomes more important; the people ride less and discard the expensive pack transportation; the horse is attached to a light vehicle with which he is able to transport more than one person or a heavier load. As the roads become better and the country more extensively cultivated, the lighter horse is used more for pleasure or solely as a means of drawing the carriage; another type of horse becomes more useful and economical, and the light-draft type appears to be succeeded by the heavy draft. Next comes the railroad, the trolley line, and the automobile. The people ride and drive less, and fewer horses of the riding types are bred. Riding is indulged in almost solely for pleasure. A new country is a country on horseback; an up-to-date one, a country in an easy chair.

In the United States the type of horse suitable for army purposes is now proportionately less numerous because it is not found necessary to the civilians of the country, and the Quartermaster's Department is finding it each year more difficult to supply the yearly demands of the mounted branch of a small army.

The horses of our mounted branches are severely criticised by representatives of foreign armies, while from our own officers come reports of poor animals, poor performance, many quickly developed unsoundnesses, and short life.

As an illustration—in the West it is found that a marked change has taken place in recent years in the so-called "cow pony." Twenty years ago cattle ranches of the West were practically without fences and unlimited, and the cow man found it necessary to breed and use a type of quick, active pony. As the West became settled and as agriculture was taken up the large free ranges changed to the large fenced pastures of a few years ago. These large pastures are now being broken up into even smaller ones. The yearly round-up requiring riding over immense distances and active work has about disappeared. To-day cattle are not chased and roped, but are driven into the small pastures and pens and quietly handled. The quick cow pony of the past has given place to a larger animal, frequently having a cross of draft blood. It may be said that the cow pony of the West has practically disappeared.

Virginia has long been famous for the horse known as the Virginia hunter. Even the breeding of this type of horse has been sadly affected by the high price of heavy draft horses and further influenced by the fact that only those hunter-bred horses that attained full size brought high prices. Under the haphazard methods of breeding in vogue in these sections not more than 1 in 6 colts could be depended upon to attain the size necessary to bring a high price, and the farmer found himself the possessor of 4 or 5 small horses for which there was no steady market. When he found that all draft colts, in spite of minor blemishes, brought good prices as 3-year-olds, he at once ceased to breed the hunter type, with its many misfits, and commenced on heavy draft horses. The disappointment in the hunter-bred horse would not have been so great had the breeding of this type been done scientifically and rationally. The hunter-bred horse as now raised in Virginia is sired almost entirely by stallions either sent to the country gratis or sold at small prices to individuals by wealthy people in the North, who desire hunters and are looking to the future supply. A farmer living in the neighborhood of a Thoroughbred

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stallion, and feeling that he would like to breed a hunter, will take advantage of the nearest and cheapest stallion in his neighborhood, regardless of what the result may be. All that he considers necessary is that the horse should be, first, a Thoroughbred; and, second, that he should be a pleasing individual; never taking into consideration the fact that the mare might not be suited to the horse nor the horse to the mare. Hence the misfits, the discouragement, and the decrease in number of the hunter type. It is said that not one-tenth as many hunters are bred in Virginia to-day as formerly.

Even more appalling than the present scarcity of horses suitable for military purposes in this country is the large number of unsound horses that are constantly being examined by purchasing officers. Horses of this class can be the result of but one thing, and that is an absolutely irrational system of breeding, or the lack of any system whatsoever. When it is remembered that a sound and serviceable horse of a particular type costs no more to raise than an unsound horse, the immense waste caused by our present lack of system is only made more apparent.

The enactment in a number of States of laws whose effect is to prohibit the standing of unsound stallions for public service will no doubt, in time, tend to correct this evil; but not until the horse-raising States generally prohibit absolutely the public stud service of unsound stallions will unsound horses be less common on the market. Such legislation in one State is an excellent thing for that particular State, but it is very likely to drive all the unsound stallions across the borders into adjoining States where laws against the unsound stallion do not exist.

The next census will probably show that there are in the neighborhood of 23,000,000 horses in the United States. It would seem that in this immense number there must be many thousands of horses suitable as remounts for the army, and there probably are; but the fact that the type desired is comparatively scarce, and that the horses that would do are scattered over an immense area and are in demand for other purposes than the military, makes it not only expensive and impracticable to obtain them, but next to impossible to do so.

The purchase of young horses for the army during the last fiscal year has been more or less successful, but all officers connected with the Quartermaster's Department have reported that while they were obtaining a fair number of horses, they could see no prospect of obtaining them in any number in future years, and all report the apparent necessity for the Government's assistance in the rational breeding of army horses in the country.

As no system of supply, so far as the army is concerned, which deals with peace conditions alone, is complete, the War Department must constantly keep in mind the possibilities of war, and it is not surprising that, finding difficulty in purchasing a supply of remounts for the peace army, there should be more or less uneasiness when war requirements are considered.

The waste of horseflesh in war times is enormous, and in a war of any magnitude in which this country might be engaged the number of horses required will not be confined to the thousands per year, but will extend into the hundreds of thousands.

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In this connection attention is invited to a few of the records on this subject:

There were purchased for the armies of the Federal Government in the fiscal year ending June 30, 1864, 188,718 horses. There were captured from the enemy and reported 20,388. Leaving out of consideration those captured and not reported, it should be observed that the army required 500 horses each day for remounts. This, therefore, is the measure of destruction of horses during the same period.

During the eight months of the year 1864 the cavalry of the Army of the Potomac was supplied with two remounts, nearly 40,000 horses. The supply of fresh horses to the army of General Sheridan during his campaign in the Valley of the Shenandoah has been at the rate of 150 per day.

During the Russian campaign the French crossed the Nieman in June, 1812, with cavalry, artillery, and train horses to the extent of 127,121. About 60,000 of these pertained to the cavalry. On December 13 the remnant of the invading army recrossed the Nieman with 1,600 cavalry horses. In six months the horses had all disappeared.

Examples of the terrible waste of horseflesh during war might be multiplied ad libitum.

The question of remounts for the army became so serious during the civil war that in 1863 the Cavalry Bureau was established. One of the principal duties of this bureau was the purchase and inspection of horses for the army. Six remount depots were established. The most important of these was Giesboro Manor, situated on the north bank of the Potomac, nearly equal distance between Washington and Alexandria. To show the magnitude of operations of the Cavalry Bureau, the following report of the Giesboro depot is given:

On hand October 1, 1863, cavalry horses	4,281	
Received to December 31, 1863	36,932	
Total		41,213
Issued	22,204	
Sold	1,651	
Died	1,637	
Total		25,492
On hand January 1, 1864		15,721
Received by purchase, January 1, 1864, to June 30, 1866		5,326
Received from other depots for issue		59,507
Received for recuperation		85,980
Received by transfer from artillery		4,120
Total		170,654
Issued to armies in the field	96,006	
Issued to officers after June 30, 1865	1,574	
Issued for sale or sold at depot	48,721	
Died	24,321	
Total		170,622
On hand June 30, 1866		32

This does not take into consideration the twelve or thirteen thousand artillery horses handled at this depot.

This report closes with the abandonment of the depot, but it is to be remembered that nearly all the volunteer cavalry was mustered out immediately after the surrender of General Lee's army the preceding year, so that nearly all the horses were handled during a period of eighteen months.

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Until recently acts of Congress appropriating money for the purchase of horses for the army required that they should be purchased by contract from the lowest responsible bidder after advertisement. The specifications of the horse to be delivered under contract are those of a perfect animal, which, of course, is seldom seen. The inspectors and purchasing officers are required to reconcile these specifications with existing conditions, keeping in mind fairness both to the contractor and to the Government. This system led to the building up of the class of middlemen who purchased animals from the breeders, presented them for the action of the government inspectors, and sold them at the contract price. Until recently this price ranged from $100 to $150. Considering the large expense to which the contractor would be put, it could not be expected that all of the Government's money would be invested in horseflesh. The result was, considering the profit by the contractor, his expenses, etc., that the price paid by the Government secured for the cavalry a horse worth from $70 to $100. Nothing is known of the breeding of these animals further than that they were "probably of such and such breeding." Often the question of breeding was not raised, the principal requisite being that they should give promise of performing the duties expected of them.

The contract system has tended to discourage the horse breeder of the country, as the money paid him by the contractor, after much haggling, was often very little more than the cost of raising the horse. There has been no incentive for breeders, even in the best naturally endowed sections, to breed the type of horse that the army needs.

Again, in recent years the demands for heavy draft animals for farming purposes, the high prices that these animals are bringing, the fact that they cost no more to raise, and bring even a higher price although blemished, has had a further bad effect upon the breeding of the desired saddle type. Even before the present high prices of all horses and the higher price of the draft horse existed, the breeding of the type considered best for army purposes received another severe setback by the adoption of electric and cable street railways and the extension of the trolleys. While not generally appreciated, the best "railroaders," as the horses used for street cars were called in the market, were the very kind that makes the best cavalry mount. This horse was desirable for street-car purposes because of his endurance and his willingness to work.

The contract system received its first serious setback, from the contractor's standpoint, when the army, due to the clamor for better mounts, insisted upon a closer compliance with the contract specifications and rejected more of the horses presented by the contractor. The sudden rise in the price of horses further embarrassed the contractor, and the added difficulty of obtaining horses to present for inspection caused many of the contractors to fail in their deliveries, made others reluctant to bid, later led to the impossibility of obtaining horses under this system in certain sections, and finally led to authority being given by Congress for open-market purchases. This method, while apparently a little more expensive to the Government, had the advantage of eliminating the middleman, giving the breeder all the money which the Government was willing to pay for horses, and giving the Government value received in horseflesh.

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The establishment in 1908 of the remount depots has further improved the type of horse for the army, as the system of purchasing young horses 3 and 4 years old, often unbroken, has enabled the Government to get the best type of horse before he has cost the breeder much money and when he could be sold for a reasonable amount. These horses, sent to the depots for maturity and handling, and finally issued to troops as 4½ and 5 year olds, while costing the Government more per head than the horses 5 and 6 years old formerly purchased and issued directly to troops, are very much better horses from the beginning, are properly developed at a critical period in their existence, rationally handled, and, when issued to troops, have been received with enthusiasm as a great improvement over the matured horses formerly issued under the old system. Even considering the high market value of horses at present, it is believed that, under the remount system, horses can be issued to troops at not to exceed a total average cost of $225. The latest contract price of cavalry horses is $183.75; for artillery horses, $213.75. Many of the late contract horses are young and require some handling at depots before suitable for service; others are mature.

Horses purchased as mature under the old system have had a useful life in the army of 6.4 years on an average. The better grade of horses, such as are now being purchased, rationally developed and handled, should and will have a useful average life of 10 years. It is easy to see that the better horse issued from the depot at a cost of $225 that lasts 10 years is cheaper than the horse costing from $183 to $213 lasting only 6.4 years. In addition the army will have had a better horse throughout the entire period of usefulness. The horses being issued from the depot could undoubtedly be sold at time of issue at a handsome profit. Many individuals would bring fancy prices. It is needless to say that if it were possible to purchase them in issue form, it would be necessary to pay much more than they have cost under the depot system.

European countries long ago found it not only advisable but necessary to supervise the breeding of horses in order to supply the demands of their armies, and every European country of importance, with the exception of England, has for years been encouraging the breeding of the proper type of army remount. England, one of the most important horse countries of the world, has for many reasons only recently been forced to this step. It is interesting to note that practically the same conditions confront England that confront this country at the present time, and that almost identical steps are contemplated in the two Anglo-Saxon countries to accomplish the same result—suitable army horses in sufficient number.

A Plan for Breeding Horses for the United States Army.

Number of stallions required.

From the best information available it would appear that a comprehensive plan to breed the horses needed for the mounted service of the army on the present peace footing should provide for not less than 2,000 horses a year and need not exceed an estimated allowance for over 2,500 a year.

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To determine the number of stallions needed for this work, allowances must be made for failure of stallions to get in foal all mares served, for ordinary losses of foals, and for failure of foals bred to prove suitable for remounts.

A good sound stallion will get about 75 per cent of his mares in foal. Of the resulting foals, an average of at least 10 per cent will die from various causes before they are old enough to be purchased as remounts. In the proposed army horse-breeding work probably about 50 per cent of the remainder would be suitable for remounts.

Based on an estimate of 100 stallions, the following results could be expected for varying numbers of mares served by each stallion:

Number of mares covered by each stallion.	Estimated number of suitable remounts by 100 stallions.
40	1,350
50	1,688
60	2,025
70	2,363

An estimate of 100 stallions would therefore appear to be conservative. It is doubtful if stallions average more than 70 mares a season, as a rule. In some localities it would probably be possible to stand stallions for a short fall breeding season in addition to the usual spring season, in which case a larger number of mares could be covered. In others only a spring season would be feasible, and a smaller number of suitable mares might be offered.

DISTRIBUTION OF STALLIONS.

The country should be divided into four or more breeding districts, as follows, and stallions assigned as indicated:

New England district (vicinity of Maine and New Hampshire)	10	Morgans.
Central district (Virginia, West Virginia, Kentucky, and Tennessee, with perhaps certain sections of Indiana and Ohio)	30	Thoroughbreds.
	10	Standardbreds.
	10	Saddlers.
Southwestern district (vicinity of Missouri or Texas, with perhaps certain sections of Iowa)	5	Thoroughbreds.
	5	Saddlers.
	5	Standardbreds.
Northwestern district (Montana, Washington, Oregon, and perhaps California)	15	Thoroughbreds.
	10	Standardbreds.
Total	100	

It might be well to subdivide one or more of these districts. The above arrangement is worked out to establish such districts so that they will be in reasonable proximity to government stations where the stallions may be kept between breeding seasons.

NUMBER OF REMOUNTS AVAILABLE ANNUALLY.

Based on the foregoing estimates, the number of remounts available yearly from these sections would be as follows, with stallions covering the maximum of 70 mares, and taking 24 as a convenient

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unit for the number of suitable remounts got by each stallion annually:

New England District	240	Half-Morgans.
Central District	720	Halfbreds.
	240	Half-Standardbreds.
	240	Saddlers.
Southwestern District	120	Halfbreds.
	120	Saddlers.
	120	Half-Standardbreds.
Northwestern District	360	Halfbreds.
	240	Half-Standardbreds.
Total	2,400	

A considerable number of the horses sired by the Morgan and Standardbred stallions would be suitable for cavalry remounts, but a much larger number would be preferable for the field artillery. The number of estimated remounts by Morgans and Standardbreds is 840. In selecting stallions of these breeds, due consideration should be given the necessity for artillery remounts.

SELECTION OF BREEDING DISTRICTS.

Those localities should be selected for breeding districts where conditions are especially suited to horse raising, where the type of mares is most likely to approach the type of horses desired for the army, where a light type of horse will always in the long run be the most profitable to the farmer and draft horses least likely to gain a firm foothold, and where mares are sufficiently numerous to give the stallions maximum service. A careful survey of the horse-raising districts of the country will be necessary before this question is settled, and the returns of the Thirteenth Census can probably be used. The Bureau of Statistics of the Department of Agriculture states that it is impossible to use its returns for this purpose. Perhaps, however, that Bureau could assist in making the survey.

The government reservations where stallions would be kept between the breeding seasons would be the points around which the work would center. In some cases it might be possible to stand some stallions on the central station itself. Stallions should be distributed in lots of five around the central stations, and such further distribution could be made as necessity required. At the close of the season they would be returned to the central station and kept there until the next or sent to another locality.

THE EXPERIMENTAL FEATURE.

The plan has experimental possibilities of the highest order, which should be utilized. The leading features are the test of the value of different breeds to produce remounts and the value of different soils and climates for the purpose, which could soon be determined by the army by keeping records of performance. Certain troops, squadrons, and batteries, and entire regiments, could be supplied with remounts bred in a certain way in certain localities, and the possibilities of the plan from an experimental standpoint would thus become very great. By the time a second large appropriation to purchase stallions would, if ever, be necessary, the Government would be in possession of facts which would enable it to show definitely whether the

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plan had been successful, and whether any crosses or localities should be eliminated from further consideration. It might be well, also, to consider the feasibility of arranging with the breeders to reserve a small number of high-class fillies each year for breeding purposes; otherwise mare owners would be compelled to replace their mares by purchase, which would bring the problem little nearer solution at the end of twenty or fifty years than it was at the beginning. That it is possible in time to fix the type desired for remounts is by no means questionable, and this may indeed be very desirable.

TERMS OF SERVICE.

No mare should be bred to a government stallion until she has been approved by the proper officer as of the type suitable to produce remounts. The common unsoundnesses, the tendency to which may be transmitted from one generation to another, should naturally disqualify a mare, but even more important would be the necessity to refuse a mare on account of manifest faults of conformation, action, or quality.

The terms of service should be free, the owner of the mare entering into a contract to give the War Department an option on the resulting foal during the year it is 3 years old (estimating a horse to be 1 year old on the 1st of January after it is foaled) at a price to be fixed before the mare is bred. A provision should be included in the contract that the mare must remain in the owner's possession until the foal is weaned, and that, in case the foal is sold before the War Department has exercised its option, a service fee shall be exacted from the breeder of the foal. Provision should be made, however, to cover such emergencies as the death of the breeder, etc.

The price contracted to be paid for remounts should be fixed annually for each State by a board of arbitration before the breeding season opens, subject to the approval of the Secretary of War. For example, in January or February, 1912, this board would meet in each State mentioned above and agree upon the price to be paid for remounts bred in that State to be purchased in 1916; in 1913 prices to be paid in 1917 would be fixed, and so on. The arbitration board should be composed of an officer of the army, an officer of the Department of Agriculture, and a citizen residing in the State, preferably a competent horseman. In purchasing remounts, no discrimination should be made against mares; colts should have been castrated at the breeder's expense, preferably between 1 and 2 years of age.

ORGANIZATION.

The breeding work would be administered by the Bureau of Animal Industry of the Department of Agriculture through the Chief of the Animal Husbandry Division. This division would direct the work under the supervision of the Chief of the Bureau, and keep the breeding records and the reports on the development of the foals. Not later than January 1 of each year it should furnish a report for transmission to the War Department on the actual number of 3-year-olds in each breeding district available for purchase during the year

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and the probable number of these that will make satisfactory remounts. A competent animal husbandman should be employed, with headquarters at Washington, as a traveling inspector of breeding stations, to keep the Department in close touch with the work in addition to receiving regular reports from the breeding districts.

The men in charge of the breeding districts should be obtained from the field force of the Bureau of Animal Industry. These men should be good veterinarians, with a thorough knowledge of horse husbandry. Their field experience would make them invaluable for this work, and the loss to the field service of the Bureau would be more than compensated by the fact that they could handle the work better than any men who might be obtained from the outside. If the Government undertakes this project it must do so under the most favorable auspices, and no risk of failure should be run. As success would largely depend on the ability of the men in charge in the field, the best men available should be obtained. The expert assistants to men in charge of breeding districts should be animal husbandry graduates of agricultural colleges, and not veterinarians. This would balance the service in a very effective way.

The duties of these men would be to direct the work at the breeding stations in their districts, to attend to the keeping of the records, to advise mare owners on the care of horses, and, if possible, to travel through their districts before the breeding season opens and approve mares, directing how they should be bred, if necessary. Until the work is on a thorough, well-organized basis, the approval of mares should be done by the men in charge of districts or their expert assistants.

The men in charge of stallions as stud grooms should be employees of the Department of Agriculture, for whose appointment experience in the handling of horses should be the first consideration. Preference should be given men who had been honorably discharged from the mounted service of the army and who presented certificates from officers in whose commands they had served showing their proficiency in horsemanship.

It is hardly necessary to point out the desirability of having the breeding service so organized that it will be carried on from year to year by the same or about the same corps of employees, in order that it may have a definite, stable, and continuous policy.

THE PURCHASE OF STALLIONS.

Stallions should be purchased by a board of three, composed of an officer of the army, an officer of the Department of Agriculture, and a practical horseman, whose knowledge of breeds, pedigree, and markets, and whose integrity can be relied upon.

In selecting the stallions, suitability for the purpose and freedom from unsoundnesses likely to appear in progeny should, of course, be first considered, and the stallions should be old enough to have shown their worth as sires of the class of horses desired. In buying Standardbreds, Saddlers, and Morgans any tendency to pace, rack, mix gaits, paddle in front, or sprawl behind, should disqualify, and only those stallions should be selected which come from families which show none of these tendencies to a marked degree. The presence of such faults in their get would, of course, disqualify them.

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EXPENSE.

It is believed that this plan could be put into full operation at a cost not to exceed $250,000 for the first year. This will allow for the purchase of first-class stallions with proved stud records and will provide for the employment of first-class men to carry on the work. The expense in subsequent years, on the same basis of 100 stallions, would require appropriations estimated at $100,000 annually, which would allow for the replacing of stallions as necessity required.

On the basis of 40 mares per stallion the system would cost about $40 per colt produced. If the maximum of 70 mares were covered by each stallion, the cost per colt produced would be about $20. Considering the fact that the normal stud fee in the country is from $10 to $25, with a probable average of $15, it will be seen that under this system the expense would be somewhat greater than by using privately owned stallions, but it is believed that the advantages of breeding and the results in foals would more than compensate for the increase. While the increased cost would not necessarily be made up to the Central Government, the increase in state and local taxes on more valuable foals would more than counterbalance the loss under this system. As a matter of fact the resultant cost of such a careful system of breeding can not be computed in dollars and cents, particularly as the effect of systematic effort in the breeding of army remounts should have such a favorable influence on all breeding in this country as to be of inestimable benefit to the horse industry and far outweigh any expense that might be debited against this system.

THE DAIRY DIVISION.

The Dairy Division, of which Mr. B. H. Rawl is chief, covers in a broad way work relating to the dairy industry. This work is organized in five branches, as follows: Dairy farming investigations, dairy manufacturing investigations, market milk investigations, research laboratories, and renovated butter inspection.

A valuable part of the work of the Dairy Division is the diffusion of helpful information among those engaged in the various branches of the dairy industry. An important means of furthering this object is by attending meetings and giving lectures and addresses. During the fiscal year the Dairy Division was represented at 327 gatherings, ranging from small local meetings of farmers to large conventions, and including meetings of live-stock and cow-testing associations, conferences of milk producers, dealers, consumers, and health officials, and meetings of medical societies, besides the giving of lectures at dairy schools, attendance at fairs and milk exhibits, and the trip of a special dairy train.

The farm at Beltsville, Md., recently acquired by the Bureau, when fully equipped will afford facilities that have long been needed by the Dairy Division for carrying out more satisfactorily investigations already under way and for investigating other problems that should be studied under actual farm conditions. The various workers of the division will thus be kept in closer touch with farm practice, and will thereby be better qualified for the work they have in hand. For lack of proper facilities much of the experimental work has hitherto been carried on in cooperation with state experiment

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stations, but it is expected that such cooperative work will not be found necessary or advisable to the same extent in the future.

With educational work the case is entirely different. It would seem that the ideal system of conducting such work in dairying would be to have it done by the States and not by the Dairy Division; but since many States are doing nothing in this direction, and others are doing but little, the division should use its efforts in helping the States to get the work started. Our experience convinces us that this is the only way that we should take up educational work, and this is the idea with which all such work now being done by the division has been undertaken and is being carried on.

DAIRY FARMING INVESTIGATIONS.

The work relating to dairy farming investigations is in charge of Mr. Helmer Rabild.

HERD RECORDS.

The low average production of the dairy cows of the United States is a condition that does more than any other one thing to prevent development. The dairyman whose herd is averaging 400 pounds of butter fat is not the man who opposes the tuberculin test or who has unimproved equipment and filthy surroundings. On the contrary, he seeks the tuberculin test, and seeks information of all kinds that will enable him to protect his herd and his business and to conduct his business in the best possible manner. The man who is fighting the tuberculin test, milk ordinances, and the inspectors, and who is continually making the greatest complaints about unremunerative prices, is usually the owner of the average cow, which produces not over 150 to 175 pounds of butter fat per annum.

Work that tends toward the improvement of the latter type of dairyman, therefore, has a direct effect upon most of the vital problems confronting the dairy industry. At present he recognizes that he derives but little profit from his business, and he naturally concludes that sanitary requirements, the tuberculin test, etc., are going to reduce his profits further, which his business can not stand. But when the productiveness of his cows has been improved and they have become profitable, he is naturally inclined, for the sake of his own business interests, to house and care for them better and to protect them from tuberculosis and other diseases. In so doing he complies with a large part of the health requirements. With herd records kept but one day in a month the best cows can soon be identified; and if a purebred bull of good quality is used, only a few years are required to develop a productive herd and bring about the conditions just indicated.

The main object, therefore, of the field work that is now in progress in the South and West, and of the cow-testing association work in the North, is to establish the use of the herd record and the purebred sire. In order to further this work in every possible way all reliable records from these various sources are collected in Washington, compiled, and interpreted, so that the results may be of most use in educating the dairyman.

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SOUTHERN FIELD WORK.

The southern field work for the development and improvement of the dairy industry, which has been continued along the same general lines as reported in previous years, is now in progress in nine States, namely: Alabama, Georgia, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia. Usually but one man works in a State and he devotes his time largely to individual dairymen located in different sections, the object being to assist one dairyman in a locality to operate his dairy in a thoroughly profitable manner, thereby providing an object lesson for the benefit of the locality. On the whole this work has been very successful. It has not only done much in the way of demonstrating the possibilities of dairying in the South, but it has also demonstrated a most practicable system of developing the dairy industry to take advantage of those possibilities.

In all the States this work has received increased attention from the state institutions, and it is fully expected that in time these institutions will take over the work entirely. North Carolina is providing funds rather liberally for the maintenance of the work, and it is probable that the Department's assistance will cease to be necessary in that State and perhaps in other States during the coming year. It is the purpose to withdraw such assistance just as rapidly as possible and transfer it to other States in the South and West.

The following are some of the particular lines of work in progress: Herd improvement and economical feeding; furnishing plans for dairy barns, silos, dairy houses, etc., and giving advice in their erection; assisting in the organization of dairy and live-stock associations; improving city milk supplies; assisting in short courses of dairy instruction and in meetings and fairs: oversight of creamery organization.

During the year records of 57 herds containing 964 cows were kept by dairymen in the South under the supervision of the Dairy Division, and in addition a number of dairymen—in one State as many as 35—have been conducting herd records without the assistance of the field men. One man keeping records under the instruction of the field agent reduced the cost of milk production from $1.34 to 69 cents per hundred pounds, a saving of nearly one-half.

The use of the purebred bull comes as immediate result of the herd records, and field workers during the past year have been able to induce about 20 dairymen to buy purebred bulls. They have also assisted farmers in the purchase of good dairy stock to replace the unprofitable cows of their herds.

Fifty silos have been built in the Southern States during the past year as a result of the work of the Dairy Division. On account of the permanency of concrete construction that type of silo is now being built whenever possible. Reports on 20 concrete silos built during the past two years show that the average cost per ton capacity was $2.35, while the average cost of 57 stave silos was $1.50 per ton capacity. One dairyman reports that in two seasons his silo has saved him at least $2,000 above its cost. A circular giving directions for building concrete silos has been prepared for publication.

Twenty-nine new barns and 10 new dairy houses were built during the past year, and 12 old barns were remodeled.

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Assistance has been given in improving the milk supplies of 20 cities, the score-card system of inspection being used.

Assistance has been given in organizing creameries in North Carolina, Tennessee, and Mississippi. Creamery promoters are constantly making an effort to sell creamery plants throughout this section. There are but few localities where dairying is sufficiently developed to make it possible to operate a creamery with success, hence the Dairy Division tries to discourage such enterprises where local conditions are such that they can not succeed. Wherever the conditions are reasonably favorable all possible assistance is given in organizing creameries and getting the work properly started.

Assistance was given by the field men at 13 fairs. At each of these a butter contest was held. A small exhibit of plans of dairy buildings was made, and publications on various dairy subjects were distributed. At a number of the fairs working dairies were conducted by the field men. A twelve months' butter contest was conducted in North Carolina. Thirty dairymen entered, and 19 remained to the close. A milk, cream, and butter contest was conducted with great success in connection with the South Carolina Dairy and Live Stock Association. One hundred and six agricultural meetings were attended by the field workers, and seven short courses of dairy instruction of from three to six days were given.

During the year three new dairy and live-stock associations were organized, and meetings were held with the six associations organized the previous year.

WESTERN FIELD WORK.

During the last few months of the fiscal year work similar to that being done in the South was begun in Colorado and Idaho. The Western States offer splendid opportunities for dairy development, and it is desirable to increase the work in that section just as rapidly as funds will permit. The number of small farmers in that section is rapidly increasing, and raising beef cattle on such farms is often unprofitable; many of the farmers therefore very readily take up dairying.

WORK WITH CREAMERY PATRONS.

Extensive as have been the investigations relating to butter manufacturing, the general quality of butter seems to continue to become lower. The competition in cream buying is often very strong, so that if one buyer refuses to take cream because it is in bad condition another buyer stands ready to take it in spite of its condition. Thus the quality of cream sold to creameries has been getting poorer and poorer. Investigations in the creamery alone are ineffective in overcoming this difficulty, and the work must be carried to the farmer. One experiment has been begun among the patrons of a creamery in Iowa whereby each patron's cream will be graded for quality, and those that are making good cream will be shown that they are receiving from 1 to 3 cents a pound less because it is mixed with the poor cream from the other patrons, while those who are producing poor cream will be offered assistance in improving the quality, and finally an effort will be made to have the cream paid for by grade. It is believed that the increased value of the better product will more than cover the cost of the improvement.

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COW-TESTING ASSOCIATIONS.

The purpose of cow-testing associations has been explained in previous reports, and this work has been made the subject of a paper in the Twenty-sixth Annual Report of the Bureau. Two men are now employed in giving assistance to state officials in organizing and conducting cow-testing associations. No assistance is given by the Dairy Division unless some state or local institution takes immediate control. During the past year 28 new associations have been organized, making a total of 55 in the United States at the present time. These associations are located as follows: Wisconsin, 12; Vermont, 9; Maine, 6; Michigan, 6; Iowa, 5; California, 3; Ohio, 3; Pennsylvania, 2; Colorado, Connecticut, Illinois, Maryland, Nebraska, New Hampshire, New York, Oregon, and Washington, 1 each.

A number of dairymen, after the first year's test has been completed, think that they have gained all the benefits to be derived from cow testing and do not wish to continue the work. It is then necessary to convince them that by continued testing the production of the herd may be further increased. An example of the advantages derived from continued testing is shown by the records of the Newaygo County Dairy Testing Association in Michigan, which has completed four years' work. The following table gives the yearly average per cow of 9 herds which have been in that association since the beginning:

Results of continued testing in a Michigan cow-testing association.

Year.	Number of cows.	Milk produced.	Butter fat produced.	Value of butter fat.	Cost of feed.	Profit.	Returns for $1 expended in feed.
		Pounds.	*Pounds.*				
1906	70	5,802	232.7	$54.66	$33.23	$21.43	$1.64
1907	85	5,987	241.4	71.02	39.29	31.73	1.81
1908	86	6,011	258.2	70.70	40.61	30.09	1.74
1909	89	6,426	277.6	86.52	43.70	42.82	1.98

This table shows an increase in the average production per cow, while the average profit has been practically doubled.

SILO AND VENTILATION EXPERIMENTS.

An experiment to determine the strength that a building must possess in order to withstand pressure of silage was reported last year. It is now in progress for the second year. This year's work may give sufficient data to warrant conclusions; if not, it will be necessary to continue the experiment for another year.

An experiment in stable ventilation was reported last year as having been in progress for two years, and the work is not yet complete. This experiment was not continued during the past winter owing to the lack of proper facilities, but will be resumed on the newly acquired farm of the Bureau as soon as sufficient equipment is available.

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DAIRY MANUFACTURING INVESTIGATIONS.

Mr. B. D. White is in charge of the section dealing with dairy manufacturing investigations.

MARKET INSPECTION OF BUTTER.

Market inspection of butter has been conducted at the New York, Chicago, and San Francisco markets. This inspection is made at the request of the dealer or the producer, and the defects of the butter are pointed out and suggestions given for overcoming them. During the fiscal year there were 3,058 inspections made, of which 1,500 were made in New York, 1,478 in Chicago, and 80 in San Francisco. Besides inspections for quality, the inspectors have made tests for salt and moisture, and have weighed shipments of butter to determine the shrinkage between the creamery and the market. In replies from 252 creameries to an inquiry from the Bureau, 184 stated that the work had proved beneficial, 59 had no opinion, and 9 knew of no beneficial results. The dealers in butter also expressed much appreciation of the inspectors' work.

CREAMERY INVESTIGATIONS.

During the year 157 new creameries have been reported. Plans for organization, articles of incorporation and by-laws, lists of machinery, and plans for creamery buildings have been furnished to these new creameries by the Dairy Division when they could be used to advantage. Besides assisting in the organization of creameries under favorable conditions, the establishment of creameries has been discouraged in localities where there was an insufficient number of cows to keep a creamery running successfully.

Investigations and advice in the management of creameries have been continued during the past year very much as heretofore. Five men have been giving the greater part of their time to this work. They have been cooperating with state departments and dairy schools in teaching creamery operators better methods. Much money is lost to creameries annually by the lack of proper business methods. The large creamery usually checks up every operation; the small creamery usually checks up none. It has been estimated that the loss from bad management in three of the leading butter manufacturing States has been reduced more than $400,000 annually within the past three years, but that those same States still sustain a loss from this source of more than $1,200,000 every year. This statement shows the benefit as well as the need of work such as the Dairy Division is doing.

Many creameries have no method of disposing of their sewage. Plans for septic tanks were sent to 39 creameries during the year. Some further study of this subject is necessary, however, to perfect the septic tank for creamery purposes, owing to the amount of grease contained in the sewage.

Nearly every creamery has some patrons who take pride in furnishing clean, sweet cream, from which the highest grade of butter can be made. At the same time there are usually many patrons who have no special interest or pride in the quality of cream they send to the creamery, so long as it is accepted; and the result is that much of the

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cream brought in is sour, tainted, or dirty, and unfit for making butter of fine quality. There are some patrons who are absolutely filthy in their practices in handling their product, and their cream is often utterly unfit for use in making a food product. The present system of paying one price for all cream is therefore unfair and should be abandoned. A few creameries have adopted a system whereby two grades are maintained. The first-grade cream must be clean, sweet, and fresh, and a premium of from 1 to 3 cents a pound of butter fat is paid for it. This cream is churned separately, and the butter from it sells at from 1 to 4 cents a pound premium. The second-grade cream is sour, but must be clean; and for it the quotation price is paid. Under this system any cream below second grade is refused. By means of grading those patrons who are interested enough to produce clean, sweet cream get a premium which is worth the effort, while the creamery gets a premium which makes the method profitable to it also. Wherever grading has been adopted it has resulted in better prices to patrons and better product from the creamery.

There is a promising field for development in the manufacture of by-products by creameries, or engaging in incidental enterprises that may well be carried on in connection with the regular work and that will avoid waste and enhance the profits; for example, manufacturing ice cream, casein, or some varieties of cheese; feeding hogs, selling sweet cream, handling eggs, manufacturing ice and condensed milk, and furnishing cold-storage space. Some creameries are already doing these things, but most of them are not, and little has been done to introduce and develop such lines of work. A tremendous amount of nutritious food is now wasted or unprofitably used by the creameries. The Dairy Division is now giving some attention to this subject of by-products and side lines, and hopes to be able to assist the creameries in taking up such enterprises.

INSPECTION OF BUTTER FOR THE NAVY.

The Dairy Division inspected during the fiscal year 768,177 pounds of butter packed on contract for the United States Navy. This butter was packed between April and August, 1909, and placed in storage. It was inspected as packed, and a sample from each churning was held until February or March, 1910, and then examined as to its condition and keeping qualities. In general this butter was found very good. It was better after eight months of storage than perhaps three-fourths of the entire amount of butter arriving on the general market. Many samples were found to be as good as when packed. Some valuable information was gained in regard to manufacturing and packing methods, and it was found that butter made according to methods recommended by the Dairy Division did not develop the fishy flavor which often injures the quality of stored butter. It is estimated that this inspection caused a saving to the Navy Department of over $50,000 in the expense for butter, and that Department has requested that the Dairy Division continue to oversee the packing of the butter for the navy.

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MARKET MILK INVESTIGATIONS.

The work of the section of market milk investigations, of which Mr. George M. Whitaker is in charge, deals mainly with the improvement of milk supplies, and is done very largely in cooperation with public health officials. In connection with this work during the past fiscal year over 150 visits were paid to various towns and cities to consult with and assist citizens and officials for the advancement of market milk conditions, and agents of the Dairy Division inspected 332 dairies and milk plants, judged in 9 milk contests, assisted in 6 dairy exhibitions, and attended and addressed 83 public meetings.

The score-card system of inspection, under which dairy farms and milk depots are inspected and rated for specific items on a scale of 100 points, is largely used in this work. One hundred and seventeen municipalities are using the score card in official inspections, in 14 States it has been adopted to a varying extent, 11 milk dealers use it in inspecting the dairies from which their supply is obtained, and 18 agricultural colleges use it in the class room. The system is in use in 8 of the 15 largest cities in the country.

The improvement brought about in the wholesomeness of the milk supply by means of this work is well illustrated by the following table, showing results in 6 cities selected from different sections of the country and representing places of a wide range of population, as reported by the local officials who made the scores:

Improvement in milk supplies of six cities as shown by score cards.

Cities.	Average score in 1909.	Average score in 1910.	Average points gained.	Percentage of gain.
Los Angeles, Cal.	55	63	8	15
Glens Falls, N. Y.	49	62	13	27
Concord, N. H.	40	46	6	15
Hudson, N. Y.	40	50	10	25
Clinton, Iowa.	56	67	11	20
Portland, Oreg.	35	45	10	28

This is an average gain of 22 per cent for the places named. The gain is always most rapid and most noticeable when the work is new, as in the above places, and when very poor conditions are being improved, though further improvement follows the continued use of the system.

The Dairy Division encourages efforts to improve the milk supply, even though the score-card method is not adopted. During the year assistance was given to 101 municipalities under these circumstances.

A month was spent by one man in an investigation of the farms which produce milk for Chicago. Dairies in all parts of the Chicago territory were inspected, and it was found that 46.7 per cent of those inspected were rated below 40, 43 per cent between 40 and 50, and only 10.3 per cent above 50. It is considered that any dairy scored below 50 should not be allowed to place milk on the market; hence it will be seen that there is much room for improvement in the Chicago territory. Fortunately, however, there is abundant evidence of improvement taking place, showing that the health department has

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started a movement which will eventually do much to raise the quality of the Chicago milk supply.

At the request of the Bureau of Chemistry in connection with its work of administering the food and drugs act, the Dairy Division has inspected and scored dairies producing milk for interstate shipment and whose product did not conform to the law.

A draft of a milk law recommended as applicable to most regions has been sent on request to many persons interested in procuring such legislation.

A paper on "The Care of Milk in the Home" was prepared during the fiscal year and has been published in a Farmers' Bulletin.

The Dairy Division has also assisted the movement for better milk by lending for various exhibitions large photographs showing good and bad dairy conditions.

RESEARCH LABORATORIES.

The research laboratories, in charge of Mr. L. A. Rogers, are devoted to experimental work, largely of a bacteriological and chemical character, with special reference to the study of processes employed and problems arising in the manufacture of dairy products. Besides the main laboratory in Washington there is a branch laboratory at Albert Lea, Minn., devoted to butter and Swiss cheese investigations. In addition, cooperative investigations with state experiment stations are being carried on at Storrs, Conn.; Madison, Wis.; and Columbia, Mo.

BUTTER INVESTIGATIONS.

Various problems relating to butter are being studied. More recent work has confirmed the results of earlier experiments in showing the superiority of butter made from sweet cream for storing purposes, and particularly when stored at a comparatively high temperature. In continuing this work, butter for storage is being made in three ways—from pasteurized sweet cream, from pasteurized ripened cream, and from ripened raw cream. Portions of each lot are stored at zero, 10° F., and 20° F. The butter is scored when put in storage and again when taken out six months later.

Experiments have been made to determine the proper temperature for pasteurizing cream for butter making. Various temperatures from 140° to 200° F. were used. Results show that an efficient temperature from a bacteriological standpoint varies with the condition of the cream, but that 160° F. seems to give the best results. The scores of butter made from cream pasteurized at from 160° to 180° F. seem comparatively uniform, but are variable below that range, and the butter has a scorched flavor above it.

The relative cost of making butter from pasteurized and unpasteurized cream is being investigated. For a period of one week all the cream is pasteurized before it is churned. The next week it is churned raw. For 19 periods this work has been in progress, and it will be continued.

Much of the cream used in some creameries is very sour when it reaches the creamery, and in order to get rid of the excess of acid it is neutralized with lime. The detection of such butter is desirable,

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but no reliable method has heretofore been available, and experiments are being conducted by the Dairy Division with a view to arriving at such a method. The experiments so far show that such butter contains an excess of calcium, although butter in which a large amount of inferior salt is used shows a similar excess of calcium. However, the magnesium content of butter is increased by the use of lime, and not by the use of salt. It is hoped, therefore, to establish a ratio of magnesium to calcium for normal butter, and thereby make possible the identification of butter from neutralized cream.

A common defect in butter is a peculiar flavor known to butter judges as "metallic flavor," which is supposed to be the product of such metals as iron and copper. Investigations regarding this matter are now under way.

An experiment is being made whereby it is sought to volatilize and condense a sufficient quantity of the flavoring matter in butter so that it may be identified. If this can be done it will help to determine the changes that take place in butter and the factors causing them. Most of this work so far has been on apparatus and methods.

A large number of cultures of lactic-acid-forming bacteria have been collected from various sources, and a study has been made of their cultural characteristics and their ability to ferment different compounds. It was found that while no distinct differentiation could be obtained by means of ordinary cultural characteristics, the fermentation of various test substances could be so coordinated that the group could be separated into several distinct varieties. While the work will be continued, a part of it is now ready for publication.

A very large amount of the farm butter now made is very inferior and sells for a greatly reduced price. Studies are being made by which it is sought to determine the causes of the serious defects in farm butter. The work done so far has been largely of a preliminary character. Samples of butter made in various sections of the country have been examined, and the methods used on a few of the best farms in Vermont are now being studied.

In maintaining an efficient inspection of the renovated butter factories and their products, more information relative to renovated butter, the packing stock used in making it, etc., is badly needed. A laboratory is therefore being equipped in which a miniature renovating plant will be installed and the various problems taken up. Only preliminary work has been done so far.

Neutral lard is doubtless used to adulterate butter, particularly renovated butter. So far no reliable method is available for determining its presence in butter unless it is there in large quantities. A study of this problem is now under way, but the work has not progressed far enough to warrant positive conclusions.

MILK INVESTIGATIONS.

An extensive study has been made of the bacteriology of commercially pasteurized and raw market milk, the milk used being purchased in Washington, New York, and Boston. All of the commercially pasteurized milk soured normally, due in part at least to the wide distribution of a strain of lactic-acid bacteria possessing exceptional resistance to heat. All changes due to bacteria are delayed in pasteurized milk for a period depending on the original bac-

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terial content of the milk, the efficiency of the pasteurization, and the handling of the milk after pasteurization. There was observed no development of bacteria in the pasteurized milk that could be said to make it more unsafe than raw milk kept under similar conditions. This work has been completed, and a full report of it is now in the hands of the printer.

An exhaustive investigation is now under way for the purpose of determining the number and variety of bacteria that survive pasteurization under controlled conditions.

The alkali-forming bacteria which cause the decomposition of milk play a very important part in market milk, and particularly in clean raw milk and pasteurized milk. Dirty milk sours quickly, and hence is discarded by the ordinary consumer before the alkali formers have had time to develop and decompose it, but such is often not the case with clean milk. A knowledge of the thermal death point of this class of bacteria is therefore very important, and a study of this subject is being made.

For several years the Dairy Division has been cooperating with the Missouri Experiment Station in conducting experiments pertaining to milk secretion. The main problem under investigation is the effect of feed on the composition and properties of milk. Before it was possible to study this problem, however, it was necessary to investigate many minor problems that had an important bearing on the main problem, such as, for example, the normal variation in milk from milking to milking, the variation occurring during the advance of the lactation period, the variation due to the cows gaining or losing in body weight, the variation due to different breeds, etc. Some of these experiments have been completed and the results published; others are almost completed. The work in progress or recently completed is as follows:

1. The effect upon the milk of gaining or losing body weight. The cows are fed so that they will gain or lose in weight, and the composition of the milk is studied.

2. The effect of cotton seed, cotton-seed meal, and cotton-seed hulls on the composition and properties of the milk. This investigation is not complete, but so far there is less effect from such feeds than is usually attributed to them.

3. The changes in milk from milking to milking. Comparisons are made between earlier and later portions of the same milking, also between milk drawn twice, three times, and four times a day. The data are practically complete.

4. The composition of human milk and changes during lactation period, as compared with cow's milk. The investigations are completed, but not ready for publication.

5. Some progress has been made in isolating and identifying the coloring matter of butter fat.

6. A method and an apparatus have been devised for measuring the hardness of butter fat and other fats. The methods previously in use were crude. The new method promises decided improvement.

CHEESE INVESTIGATIONS.

SWISS CHEESE.—The investigations at Albert Lea, Minn., relative to various problems involved in the manufacture of the Swiss type of cheese, have been continued. Most of this work has been prelimi-

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nary in character. The use of "starters" has resulted in some improvement of the texture and possibly a suppression of gas formers. On a commercial scale conflicting results have been obtained.

CHEDDAR CHEESE.—Experiments in coating cheese with paraffin to improve its keeping qualities have been made to determine the temperature at which paraffin should be applied, the length of the application, and the age of the cheese at which it is best to apply the paraffin. The best results were secured with paraffin at a temperature of 240° F. when the cheese was three days old.

Some preliminary work has been done on the feasibility of canning cheese of the Cheddar type directly from the press. Cheese put up in this way ripens normally, but has a softer texture than ordinary cheese. This work will be continued by comparing canned cheese with cheese made from the same vat and ripened in the ordinary way.

A study is being made at Madison, Wis., in cooperation with the Wisconsin Experiment Station, of such problems as the influence of various factors, such as acidity of milk, proportion of rennet used, size of curd cubes, time, temperature, pressure, etc., on the moisture content of cheese. The results thus far obtained have been published in Bulletin 122.

As a result of the investigations in making cheese from pasteurized milk the method has been so perfected that it is possible to bring factory milk into practically uniform condition every day, so that a definite routine method of manufacture may be followed throughout the year. From February to July, between 150 and 300 pounds of cheese were made daily by this process. The cheese has been very uniform in quality, has had a clean, mild flavor, free from taints, and an almost perfect texture. This cheese has been sold at the highest market price. On account of its good texture and the tendency to hold its shape, a large part of this cheese has been shipped to the Southern States, and the reports indicate that it is superior for this purpose to the ordinary cheese.

An extended study has been made of the volatile fatty acids and esters formed in the ripening of normal cheese and in cheese made from pasteurized milk, and their relation to the development of flavor. These products have been found absent in cheese treated with chloroform, indicating that their origin is due to a biological factor or enzymatic agent produced by lactic-acid organisms.

SOFT CHEESE.—Several European varieties of soft cheese are of great commercial importance in the United States, and for a number of years the Dairy Division has been investigating them in cooperation with the Storrs (Conn.) Agricultural Experiment Station, with a view to their production in this country.

Most of the problems connected with the production of the Camembert type of cheese in the United States have been fully covered and the results obtained have been published in several bulletins of this Bureau. During the early part of the year the enzym experiments were continued, particular attention being given to the enzym that was found to be directly concerned in the ripening of this cheese. It is necessary to resume some portions of this work at a later time. It is also contemplated to continue experiments in order to study three points not fully covered in previous reports, namely, the effect of relative humidity of the air in the ripening room upon the water

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content in cheese containing various initial percentages of water, the effects of increasing the percentage of salt in Camembert cheese as suggested by recent studies of Roquefort, and the desirability of lowering the curdling temperature 2 to 3 degrees, as has been found effective in Roquefort.

The staff at Storrs has devoted the greater portion of the past year to the study of the Roquefort type of cheese. In regard to the practical part of the work, two cheeses of this type are made each day, and a cheese maker is fully occupied in keeping the necessary records and in caring for the cheese in the ripening cellar. The ripening period averages between three and four months. Regarding the chemical work, one of the first problems was to determine the proportions of the various constituents, so as to ascertain, if possible, the distinguishing features between this and other varieties of cheese. The high percentage of salt was found to be of great importance. An analysis of all the brands of imported Roquefort cheese brought out the fact that the salt content of this type of cheese is quite uniformly about 4 per cent. Very few other kinds of cheese show even half of this percentage. The consistently high quality found in imported Roquefort cheese made a special study of this point necessary. The effect of salt in cheese was studied in addition, from a bacteriological point of view, and also with regard to the molds. A preliminary report covering the problems considered and the progress made in this branch of the work is in course of preparation.

MYCOLOGICAL WORK.—Molds are of considerable economic importance not only in cheese making but in many other branches of agriculture. Studies have been continued upon species of *Aspergillus* and *Penicillium*. These two genera include a large majority of the molds which are found in studying dairy, food, and household problems. Several experiment stations are studying the toxic effects of feeding moldy grain to domestic animals, and many of the organisms discovered in such work are sent to the laboratory at Storrs for identification and verification. This work is being organized and continued in such manner as to be of permanent value.

RENOVATED BUTTER INSPECTION.

The inspection of renovated or "process" butter and of the factories where it is produced is carried on under the act of Congress of May 9, 1902, and is in charge of Mr. Robert McAdam. The Dairy Division is assisted in this work by some of the members of the meat-inspection force of the Inspection Division, as it is found that the same men can often attend to both classes of inspection in the same localities. In this work the Bureau also cooperates with the revenue officers of the Treasury Department, especially by making moisture tests and notifying those officials when butter is found containing moisture in excess of the legal limit of 16 per cent.

During the past fiscal year 42 factories were bonded for the purpose of manufacturing renovated butter, although several of these did not operate throughout the entire year. These factories produced during the year 46,914,494 pounds of renovated butter, a decrease of 517,782 pounds from the preceding year. There was a heavy decrease of exports of this butter, the exports being only 41,850 pounds, as compared with 1,115,288 pounds exported during the previous year.

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DAIRY ARCHITECTURE AND ENGINEERING.

For the past few years the Dairy Division has prepared plans for dairy buildings and distributed blueprints to a limited extent. This has been continued during the past year, and it has also been found desirable to take up some of the engineering and mechanical problems connected with the dairy industry, such as the equipment of buildings, refrigeration, sewerage systems, and apparatus of various kinds. Some of this work is necessary to investigations carried on by the Dairy Division, aside from its advantage to the industry. In connection with creameries and milk production there is need for much work on ice houses and refrigerating machinery. Storing ice is a practice that should be encouraged among dairy farmers. It is hoped that the facilities for work of this kind may be enlarged.

THE INSPECTION DIVISION.

The work of the Inspection Division, under the direction of Dr. R. P. Steddom, chief, consists of the meat inspection and the control and eradication of contagious diseases of animals.

THE MEAT INSPECTION.

The meat inspection was conducted during the past fiscal year at 919 establishments, located in 237 cities and towns, as compared with 876 establishments in 240 cities and towns the previous year. Inspection was inaugurated at 105 establishments and was withdrawn from 91 establishments during the year, as compared with 180 establishments and 77 establishments, respectively, during the previous year. In 70 cases the cause of withdrawal was that the establishments discontinued slaughtering or interstate business, and in 14 cases withdrawal was due to insanitary conditions or to failure or inability to meet the Department's requirements as to sanitation or other matters.

The following statement shows the number of establishments and the number of cities and towns where the inspection of meat and meat food products was conducted by the Bureau in each fiscal year, beginning with 1891:

Number of establishments and number of cities and towns where meat inspection has been conducted, fiscal years 1891 to 1910.

Year.	Establishments.	Cities and towns.	Year.	Establishments.	Cities and towns.
1891	9	6	1901	157	52
1892	23	12	1902	155	50
1893	37	16	1903	156	50
1894	46	17	1904	152	51
1895	55	19	1905	151	52
1896	102	26	1906	163	58
1897	128	33	1907	708	186
1898	135	35	1908	787	211
1899	139	42	1909	876	240
1900	149	46	1910	919	237

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During the fiscal year market inspection was extended to two more cities, making a total of 39 cities at whose public markets federal meat inspection is conducted in order that interstate deliveries may be made without violating the meat-inspection law and regulations.

ANTE-MORTEM INSPECTIONS.

The number of animals of each species inspected before slaughter is shown in the following statement, which, though showing a material increase in the number of cattle, calves, sheep, and goats inspected, shows so large a decrease in the number of swine as to make the total ante-mortem inspections over 7,000,000 less than in the previous year:

Ante-mortem inspections of animals, fiscal year 1910.

Kind of animals.	Passed.	Suspected.[a]	Total.
Cattle	7,956,427	43,120	7,999,547
Calves	2,293,216	2,584	2,295,800
Sheep	11,155,646	8,989	11,164,635
Goats	116,035	28	116,063
Swine	27,717,164	14,463	27,731,627
Total	49,238,488	69,184	49,307,672

[a] This term is used to designate animals found diseased or suspected of being unfit for food on ante-mortem inspection, most of which are afterwards slaughtered under special supervision, the final disposition being determined on post-mortem inspection.

POST-MORTEM INSPECTIONS.

The inspections made at the time of slaughter are shown in the following statement which, while showing an increase in the slaughter of all classes of animals except swine, shows a decrease of nearly 6,500,000 animals as compared with the preceding year:

Post-mortem inspections, fiscal year 1910.

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	7,916,601	3,162	42,426	7,962,189
Calves	2,287,568	7	7,524	2,295,099
Sheep	11,138,781	29	11,127	11,149,937
Goats	115,585	.....	226	115,811
Swine	27,532,600	70,982	52,439	27,656,021
Total	48,991,135	74,180	113,742	49,179,057

In the foregoing table are included the post-mortem inspections of the carcasses of animals "suspected" on ante-mortem inspection, the final inspections of carcasses that were retained[a] at the time of

[a] This term is applied to carcasses held on suspicion on first post-mortem examination to be subjected later to more thorough examination for determining final disposition.

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slaughter, and the carcasses of animals slaughtered without ante-mortem inspection and presented at inspected establishments with the head and viscera attached as required by Regulation 20 of the meat-inspection regulations.

The various diseases and conditions for which fresh carcasses and parts were condemned and tanked are shown in the following table:

Diseases and conditions for which condemnations were made on post-mortem inspection, fiscal year 1910.

Cause of condemnation.	Cattle.		Calves.		Swine.		Sheep.		Goats.	
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.
Tuberculosis	27,638	48,997	184	166	28,882	720,775	.....	.....	.....	.....
Actinomycosis	527	53,008	1	85	.....	.....	.....	.....	.....	.....
Caseous lymphadenitis	.....	.....	.....	.....	.....	.....	1,122	.....	25	.....
Hog cholera	.....	.....	.....	.....	7,677	.....	.....	.....	.....	.....
Tumors and abscesses	171	7,070	35	61	932	1,516	164	41	3	.....
Septicemia, pyemia, and uremia	1,027	.....	309	.....	5,561	.....	539	.....	11	.....
Pregnancy and recent parturition	209	.....	.....	.....	40	.....	72	.....	.....	.....
Immaturity	.....	.....	3,472	.....	.....	.....	.....	.....	.....	.....
Pneumonia, pleurisy, enteritis, hepatitis, nephritis, metritis, etc	1,872	.....	346	.....	4,502	.....	1,572	.....	54	.....
Icterus	74	.....	43	.....	1,248	.....	909	.....	13	.....
Texas fever	435	.....	657	.....	.....	.....	.....	.....	.....	.....
Injuries, bruises, etc	3,333	5,253	499	166	383	2,915	657	183	11	1
Sexual odor	.....	.....	.....	.....	786	.....	.....	.....	.....	.....
Asphyxiation	.....	.....	.....	.....	630	.....	42	.....	.....	.....
Emaciation	6,476	.....	1,762	.....	932	.....	5,376	.....	81	.....
Miscellaneous	664	7,839	216	22	866	1,623	674	24,490	28	.....
Total	42,426	122,167	7,524	500	52,439	726,829	11,127	24,714	226	1

SUPERVISION OF PREPARATION OF MEATS AND PRODUCTS.

The amount of meats and meat food products prepared and processed under the supervision of the Bureau is shown in the following statement, being a decrease of 8.5 per cent from the preceding year:

Meat and meat food products prepared and processed under Bureau supervision, fiscal year 1910.

Kind of product.	Weight.	Kind of product.	Weight.
	Pounds.		*Pounds.*
Beef placed in cure	205,762,443	Bakers' compound	2,499,309
Pork placed in cure	2,216,680,470	Oleo stock and edible tallow	55,034,672
All other classes placed in cure	2,223,590	Oleo oil	156,374,212
Sausage, chopped	485,863,902	Oleo stearin	83,713,020
Canned beef	107,050,501	Oleomargarin or butterine	139,158,391
Canned pork	17,862,128	Mutton stock	325,604
All other canned meats	2,350,311	Mutton oil	1,016,510
Meat extract	429,861	Mutton stearin	715,291
Steam and kettle rendered lard	865,270,940	Oleo and mutton stock	105,930
Leaf lard	19,899,786	Oleo and mutton oil	1,069,865
Neutral lard	63,297,635	Oleo and mutton stearin	131,410
Lard oil	6,736,004	Miscellaneous products	1,115,676,133
Lard stearin	5,689,868		
Lard compound	11,537,949	Total	6,223,964,593
Lard substitute	657,488,849		

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The following amounts of meat and meat food products were condemned on reinspection during the fiscal year because of having become sour, tainted, putrid, unclean, rancid, or otherwise unwholesome: Beef, 9,566,199 pounds; pork, 9,273,124 pounds; mutton, 137,598 pounds; veal, 54,616 pounds; goat meat, 271 pounds; total, 19,031,808 pounds. For the past two years there has been a steady and marked decrease in condemnations for these causes as a result of continued improvement in sanitary conditions and in methods of preparing and handling the products.

INTERCHANGE OF MEATS BETWEEN INSPECTED ESTABLISHMENTS.

Considerable quantities of meats and meat food products that have been inspected and passed are transferred between inspected establishments, this traffic being closely supervised and the meats and products identified by means of marks and seals. During the fiscal year there were transferred in this manner 2,734,019,943 pounds of meats and meat food products, part of which was contained in 16,073 sealed cars and 21,169 sealed wagons.

MEATS AND PRODUCTS CERTIFIED FOR EXPORT.

The amounts of meat and meat food products certified by the Bureau for export are shown in the following table, being a decrease of 30.7 per cent as compared with the previous fiscal year:

Inspection certificates issued for export of meat and meat food products, fiscal year 1910.

Kind.	Number.	Beef.	Mutton.	Pork.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Regular	42,265	212,408,598	4,680,846	377,380,234	594,469,678
Preservative	29,767	1,947,144	.....	218,945,328	220,892,472
Total	72,032	214,355,742	4,680,846	596,325,562	815,362,150

There were also issued 2,174 "inedible product" certificates, covering exports of 17,676,942 pounds of such inedible products as hoofs, horns, casings, bladders, bungs, etc.

IMPORTED OLEO STEARIN.

During the fiscal year 23,416,479 pounds of compound and 118,300 pounds of oleomargarin were manufactured from imported oleo stearin at five inspected establishments located at three seaport cities (Jersey City, New Orleans, and New York). This imported product is kept under lock and key while in these establishments and no domestic meat food product is permitted to be mixed with it. The finished product is also kept under lock and is promptly loaded into vessels and exported without certificates, stamps, or other marks of federal meat inspection.

EXEMPTION FROM INSPECTION.

The provisions of the meat-inspection law requiring inspection do not apply to animals slaughtered by farmers on the farm nor to retail butchers and dealers. The Department requires that such

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butchers and dealers, in order to ship meats and meat food products in interstate commerce, shall first obtain certificates of exemption, but no such requirement is made of farmers. The number of certificates of exemption outstanding at the close of the fiscal year was 2,428, as against 2,114 at the close of the previous fiscal year, an increase of 314 certificates. During the year it was found necessary to call in and cancel for various causes 428 certificates of exemption. In many of these cases, however, the certificates were reissued later when business was resumed or when insanitary conditions had been corrected.

During the year 118,800 shipments were made under certificates of exemption, covering 19,932,221 pounds of meat and meat food products. Included in these shipments were 102,409 carcasses, of which about 90 per cent were veal.

INSPECTIONS FOR THE NAVY.

Upon request of the Navy Department occasional inspections of meats and meat food products were made for the navy during the year. These inspections were made at Baltimore, Boston, Brooklyn, Jersey City, Los Angeles, New Orleans, New York, Norfolk, Philadelphia, Providence, San Francisco, Seattle, and Washington. The meats and products inspected aggregated 6,448,072 pounds, of which 234,313 pounds were rejected. Rejections were made on account of the sour, slimy, tainted, or putrid condition of the product, for failure to comply with the specifications regarding weight, and because of the substitution of buck, heifer, or cow meat for the meat of wethers and steers as specified.

CONTROL OF CONTAGIOUS DISEASES.

TEXAS FEVER.

The number of cattle shipped during the quarantine season of 1909 to northern markets from the area quarantined on account of Texas or splenetic fever of cattle was 1,394,658, being an increase of 252,854 head, or 22.23 per cent, as compared with the previous year. These were carried in 46,741 cars, 45,757 of which were reported as having been cleaned and disinfected under Bureau supervision. The number of inspected or dipped cattle moved interstate from the provisionally quarantined area under 1,859 certificates of inspection issued by Bureau inspectors was 143,545.

During the fiscal year 35,081 head of southern cattle were dipped in crude petroleum or otherwise treated under Bureau supervision for unrestricted movement, as provided in the regulations.

TICK ERADICATION.

As the result of the work done in cooperation with authorities of various States for the extermination of the ticks which spread the infection of Texas fever of cattle, areas aggregating more than 57,000 square miles, as shown by the following table, were released from quarantine during the fiscal year:

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Areas released from cattle quarantine as a result of tick eradication.

State.	Square miles.	State.	Square miles.
California	32,271	Georgia	815
Texas	10,675	South Carolina	2,673
Oklahoma	3,076	Virginia	1,696
Arkansas	3,464		
Mississippi	1,407	Total	57,518
Tennessee	1,442		

In addition to the States represented in the above list, active operations are being carried on in North Carolina, Alabama, and Missouri.

During the year the total number of inspections made by Bureau employees was 3,745,548, of which 2,589,082 were reinspections. This is an increase of 14.5 per cent over the inspections of the previous year.

SCABIES IN SHEEP.

The area quarantined for scabies in sheep was reduced during the fiscal year by releasing from quarantine 390,000 square miles, comprising the State of Washington and portions of Oregon, Nevada, Utah, Arizona, and Colorado, while the State of Kentucky was placed in quarantine.

The number of inspections made by Bureau employees during the fiscal year was 52,749,920, a decrease of 11.7 per cent from the previous year. The number of dippings supervised by Bureau employees was 12,153,356, a decrease of 22.1 per cent, and the number of cars cleaned and disinfected was 2,577.

SCABIES IN CATTLE.

The area quarantined for scabies in cattle was reduced during the fiscal year by releasing 53,021 square miles, consisting of one county in Montana, two counties in Wyoming, parts of five counties in Colorado, seven counties in Nebraska, nine counties in Kansas, and nine counties and parts of four counties in Texas.

The number of inspections made was 18,190,456, a slight increase over the previous year.

The number of dippings supervised was 1,336,829, a decrease of 14.3 per cent, and 8,723 cars were cleaned and disinfected.

GLANDERS IN HORSES.

There were inspected for glanders at Indian schools and agencies 16,264 horses and mules, of which 22 were found diseased and 479 exposed to the disease. This work was done in cooperation with the Office of Indian Affairs of the Department of the Interior.

SCABIES IN HORSES.

The number of horses and mules inspected for scabies during the year was 11,761 and the number dipped was 1,216.

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LIP-AND-LEG ULCERATION IN SHEEP.

For several years there has existed in several of the Western States a contagious disease known as lip-and-leg ulceration (necrobacillosis) among sheep, but during the past year this disease seemed to become more extensive and assumed a very virulent form in the State of Wyoming; and, in order that its spread to other States might be prevented, eight counties in that State were, on August 12, 1909, placed under federal quarantine. The number of inspections during the year for this disease was 34,549,974. The number of dippings and disinfections reported during the year was 2,765,773, with the result that a recent inspection of sheep on the range shows that the disease is decreasing in virulence and that there has been a large decrease in the number of diseased sheep, as compared with the inspection in the fall of 1909.

REPORTS OF VIOLATIONS OF LIVE-STOCK TRANSPORTATION LAWS AND REGULATIONS.

During the fiscal year employees of the Bureau made about 550 reports of alleged violations of what is known as the twenty-eight-hour law and 200 reports of alleged violations of the act of March 3, 1905, and regulations based thereon. The information thus obtained was placed before the Department Solicitor, who presented to the Department of Justice for prosecution such cases as seemed to be supported by sufficient evidence. Many of the cases tried required special investigations and the collection of evidence by employees of the Bureau, who cooperated with the United States attorneys in charge of the cases.

THE QUARANTINE DIVISION.

The Quarantine Division, of which Dr. R. W. Hickman is the chief, deals mainly with the inspection and quarantine of imported live stock, the inspection of live stock for export, cooperative investigations with state and municipal authorities concerning bovine tuberculosis, interstate tuberculin testing of cattle, and investigations of animal diseases in Porto Rico and the Hawaiian Islands.

INSPECTION OF VESSELS AND EXPORT ANIMALS.

During the fiscal year 443 inspections of vessels carrying live stock were made before clearance, in order to see that the regulations were complied with as to fittings, equipment, ventilation, feed, water, attendants, etc., and 650 certificates of inspection were issued for American cattle. The following table gives statistics of inspection of live animals for export during the year:

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Inspections of American and Canadian animals for export, fiscal year 1910.

Kind of animals.	American.				Canadian.		
	Number of inspections.	Number rejected.	Number tagged.	Number exported.	Number of inspections.	Number rejected.	Number exported.
Cattle	225,089	148	120,699	120,351	60,384	27	60,357
Sheep	2,688	.....	.....	1,828	1,988	.....	1,988
Swine	463	.....	.....	463	.....	.....	.....
Horses	880	.....	.....	879	.....	.....	.....
Mules	742	.....	.....	742	.....	.....	.....
Donkeys	1	.....	.....	1	.....	.....	.....
Elk	24	.....	.....	24	.....	.....	.....
Bison	1	.....	.....	1	.....	.....	.....
Eagles	4	.....	.....	4	.....	.....	.....
Total	229,842	148	120,699	124,293	62,372	27	62,345

Most of the animals included in the above statement were shipped to Great Britain, namely, of American animals, 119,525 cattle, 848 sheep, 510 horses, 1 donkey, and 14 mules, and of Canadian animals, 59,914 cattle and 1,342 sheep.

The inspection of vessels carrying export animals and the enforcement of the regulations continue to result in an exceedingly low percentage of losses of animals in transit. Statistics of animals landed at British ports show that only 0.12 per cent of the cattle and 0.80 per cent of the sheep were lost at sea, while no horses or other animals were lost.

During the fiscal year 10,257 horses were inspected by Bureau veterinarians for shipment to Canada, 7,866 of which were tested with mallein to determine whether or not they were affected with glanders, and 146 were rejected on account of reacting to the mallein test. There were also inspected for exportation to Canada 1,614 cattle, 21,795 sheep, 64 swine, 249 goats, and 1,038 mules. Of the cattle there were tested with tuberculin 560, of which 21 reacted and were rejected. Of the mules 923 were tested with mallein and 8 were rejected.

For shipment to the Hawaiian Islands there were tested with mallein 65 horses and 613 mules, of which 8 horses and 14 mules reacted to the test; also 179 cattle were tested with tuberculin, 23 of which reacted.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

Owing to the existence of communicable diseases of animals among the live stock of various parts of the world, importations from over seas have been restricted to Great Britain, Ireland, and the Channel Islands, and it is required that a permit be procured from the Secretary of Agriculture prior to shipment from countries other than North America for cattle, sheep, and other ruminants, and swine, for their landing subject to inspection, and their detention in quarantine at one of the federal quarantine stations at the port of entry. Horses are admitted subject to inspection and without quarantine.

The number of animals imported during the fiscal year is shown in detail by the following tables:

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Number of imported animals inspected and quarantined, fiscal year 1910.

Ports of entry.	Cattle.	Sheep.	Swine.	Goats.	Other animals.
New York	1,912	140	16	9	133
Boston	226	635	7	3	16
Philadelphia					9
San Francisco					5
Candian border ports	147	6,522	3		
Total	2,285	7,297	26	12	163

Number of imported animals inspected but not quarantined, fiscal year 1910.

Ports of entry.	Cattle.	Sheep.	Swine.	Horses.	Mules.	Goats.	Other animals.
New York				5,948	68		5
Boston	1			181			1
Philadelphia				3	3		2
Baltimore				24			
San Francisco				5			
Portland, Me				58			
New Orleans				10	1		
Mexican border ports	190,616	18,462	1,423	1,892	3,105	6,539	60
Canadian border ports	3,204	98,170	588	6,262	37	16	183
Total	193,821	116,632	2,011	14,383	3,214	6,555	251

TESTS IN GREAT BRITAIN AND CANADA.

The regulations governing the importation of animals subject to inspection and quarantine provide that all cattle 6 months old or over imported from Great Britain, Ireland, and the Channel Islands shall be tested with tuberculin by an inspector of the Bureau of Animal Industry before being exported or after arrival at the animal quarantine station at the port of entry. The following table shows the results of such tests made in Great Britain during the fiscal year:

Results of tuberculin tests in Great Britain of cattle for importation, fiscal year 1910.

Breed.	Passed.	Failed.	Breed.	Passed.	Failed.
Aberdeen-Angus	6	0	Red Polled	13	0
Ayrshire	116	45	Shorthorn	38	10
Dexter-Kerry	42	0			
Guernsey	[a] 842	12	Total	1,929	74
Jersey	872	7			

[a] Thirty-eight of these were for shipment to the United States via Canada.

During the fiscal year 723 cattle were tested with tuberculin for importation from Canada into the United States, 13 of which reacted and were rejected. Of 163 horses tested with mallein, 3 reacted. Two mules were likewise tested with mallein and were admitted.

PREVALENCE AND ERADICATION OF BOVINE TUBERCULOSIS.

The investigations made during the fiscal year 1909 concerning the prevalence and extent of bovine tuberculosis were so well supported by the States that it was deemed advisable to extend them during the

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past fiscal year. The work for this year shows a great increase in the number of tuberculin tests applied, and includes testing in connection with the eradication of tuberculosis from a State or the locality surrounding a city requiring a tuberculin test for the protection of its milk supply, and testing of cattle at stock yards for interstate movement. In cooperating with States and cities it has been customary for them to place veterinarians in the field to work in conjunction with this Bureau's inspectors. These investigations have served an excellent purpose in educating the public to the importance of the eradication of bovine tuberculosis as a public-health measure, and have brought many cattle owners to a realization of the economic value of eradicating the disease from their herds.

During the past year the number of States and Territories requiring a satisfactory tuberculin test as a qualification for the entrance of cattle for dairy or breeding purposes from other States or Territories has increased to a total of 35. Unfortunately, in many States there has been no adequate appropriation of funds for the indemnification of owners, the proper enforcement of the laws, or carrying on the work. To assist States in getting the work started, and to avoid delays and inconvenience to shippers, the application of the tuberculin test to cattle by this Bureau was undertaken at a number of new points. Toward the end of the fiscal year it was decided that as the interstate tests had given such general satisfaction, the Bureau would establish testing stations at the majority of stock yards through which cattle pass and where government inspection is being maintained, and it was deemed advisable to place the interstate testing of cattle under the direction of the Inspection Division at the beginning of the new fiscal year, as that division already had control of the regular yard inspections.

The following table shows the cooperative tuberculin testing performed during the past fiscal year for the interstate movement of cattle:

Results of tuberculin tests of dairy and breeding cattle for interstate movement, fiscal year 1910.

State.	Number of cattle tested.	Number passed.	Number reacting.	Number of suspects.	Percentage of reactors and suspects.
Minnesota	3,657	3,544	102	11	3.09
North Dakota	1,055	1,041	14	0	1.33
Oregon	809	789	15	5	2.47
Nebraska	773	759	13	1	1.81
Kansas[a]	278	277	1	0	.36
Colorado	224	210	12	2	6.25
Idaho	123	103	9	11	16.26
Virginia	106	94	12	0	11.32
Illinois[a]	45	43	1	1	4.44
Montana[a]	33	33	0	0	.00
Michigan[a]	31	28	2	1	9.68
California[a]	25	25	0	0	.00
Total	7,159	6,946	181	32	2.98

[a] Testing recently inaugurated.

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The following are the tabulated results of tuberculin tests applied by Bureau inspectors as a result of cooperation extended to States or cities:

Results of tuberculin testing of dairy cattle for States and cities, fiscal year 1910.

State or city.	Number of cattle tested.	Number passed.	Number reacting.	Number of suspects.	Percentage of reactors and suspects.
Utah	6,321	5,898	332	91	6.69
Kentucky	5,762	5,376	319	67	6.70
Nebraska	5,311	4,815	486	10	9.34
Arkansas	4,988	4,905	59	24	1.66
New Mexico	4,838	4,733	82	23	2.17
Oregon	2,737	2,134	519	84	22.03
Iowa:					
Waterloo	2,697	2,439	233	25	9.70
Idaho:					
Boise	661	646	5	10	2.27
South Dakota[a]	514	495	10	9	3.70
North Dakota[a]	213	182	24	7	14.55
Total	34,042	31,623	2,069	350	7.11

[a] Herds at public institutions.

The tuberculin testing of cattle in Virginia and Maryland, which was started in 1907 in cooperation with the health department of the District of Columbia with a view to obtaining a healthful milk supply for the city of Washington, was continued throughout the past fiscal year. The requests from owners, especially in Virginia, for the application of tuberculin tests to their herds, having spread beyond those herds supplying milk to the District of Columbia, it was decided to extend the Bureau's cooperation into other parts of Virginia, working with the office of the dairy and food commissioner of that State and in accordance with the act of the state assembly passed in March, 1910. The owners have been required, in accordance with the custom of the Bureau, since the inauguration of the work, to sign an agreement with the Bureau for the testing of their cattle, and providing for the proper disposal of reacting animals, the disinfection of premises, and the protection of their herds from the entry of untested stock. The results of tuberculin tests applied to cattle in the States of Virginia and Maryland are shown by the following table:

Results of tuberculin testing of dairy cattle in Virginia and Maryland, fiscal year 1910.

Item and State.	Number of cattle tested.	Number passed.	Number reacting.	Number of suspects.	Percentage of reactors and suspects.
Cattle not previously tested:					
Virginia	1,100	899	162	39	18.27
Maryland	343	289	48	6	15.74
Total	1,443	1,188	210	45	17.67
Annual retests:					
Virginia	966	923	39	4	4.45
Maryland	309	301	5	3	2.58
Total	1,275	1,224	44	7	4.00

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The following is a summary of all the tuberculin tests applied under the supervision of the Bureau during the fiscal year in connection with the work hereinbefore reported, also including tests applied in the District of Columbia as hereinafter reported:

Number of cattle tested	45,620
Number apparently free from tuberculosis	42,361
Number of reactors and suspects	3,259
Percentage of reactors and suspects	7.14

This summary, compared with that of the preceding year, shows an increase of 36,811 in the number of cattle tested.

THE ERADICATION OF BOVINE TUBERCULOSIS IN THE DISTRICT OF COLUMBIA.

In cooperation with the Commissioners of the District of Columbia the eradication of tuberculosis of cattle in the District was undertaken in the fall of 1909.

On November 26, 1909, there was issued an "Order of the Commissioners of the District of Columbia for the Suppression and Prevention of Tuberculosis in Cattle," which order was approved by the Secretary of Agriculture, and work was begun November 29 by the Bureau of Animal Industry through the Quarantine Division. The principal features of the order were as follows:

Owners of cattle were required to obtain a permit for the entry of cattle into the District of Columbia. When not accompanied by a satisfactory official tuberculin test chart, cattle were to be quarantined until tested within the District. All cattle entering the District for slaughter were required to be tagged for identification, the tag to remain attached to the hide until removed in the presence of a Bureau employee. All cattle over 6 months old already within the District of Columbia were required to be inspected and tested with tuberculin, and reacting animals were to be slaughtered. Provision was made for the appraisement of reacting cattle, and for partial reimbursement upon a percentage basis, depending upon whether or not the tuberculous lesions found upon post-mortem examination were slight and localized, or extensive and requiring the condemnation of the carcass to the fertilizer tank, the amount received from the sale of the carcass or hide being deducted from the proper percentage of the appraised value, the remainder, if any, being paid to the owner of the cattle. All premises upon which tuberculous animals had been kept were required to be promptly disinfected under official supervision. Provision was likewise made to prevent the illegal entry of cattle into the District and for punishment in case of violations.

In order to systematize the work it was started in the southeastern corner of the District, and a designated area was canvassed with a view to ascertaining the number, location, and ownership of all bovine animals therein. Six veterinary inspectors were then assigned to apply the tests. This method of procedure was followed until the testing of all cattle within the District of Columbia was once covered, namely, to April 2, 1910. Meanwhile all cattle, including calves, entering the District of Columbia from Maryland and Virginia or other States were identified, tagged, and permitted entry in accordance with the order of the commissioners. On March 5, 1910, an amendment was issued to the order of the commissioners, in accordance with which calves under six months old and castrated cattle were permitted entry for slaughter purposes without restrictions.

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The slaughter of cattle which had reacted to the tuberculin test created an increased demand for dairy cows within the District, and cattle dealers hastened to purchase cattle to supply this demand. Such cattle entered the District after identification and upon a permit, and were tested with tuberculin upon the premises of the dealer, who bore the loss of any cattle which reacted, without reimbursement. Thus cattle owners were enabled to replace promptly their diseased animals with cattle known to be free from tuberculosis.

After the finding of reactors upon any premises a satisfactory appraisement was made and the cattle sold, subject to official post-mortem inspection, to the butcher submitting the highest bid. Following the removal of reactors, premises previously occupied by them were thoroughly cleaned and disinfected under supervision of employees of the Bureau, a strong force pump being supplied for use in this connection. In all dairy barns bichlorid of mercury, in aqueous solution, 1 to 800, was employed in disinfecting.

Throughout the entire work the cattle owners and dealers cooperated with the Bureau.

The following is a summary of the results obtained within the District in the primary application of the test: The total number of cattle tested in the District of Columbia was 1,701, of which 1,380 passed, and the remaining 321, or 18.87 per cent, were regarded as tuberculous and were slaughtered. Of these reactors, 305 were appraised before slaughter, and for the remaining 16 reimbursement was not claimed, as they were in government-owned herds. The post-mortem inspections of these carcasses verified the correctness of the tuberculin reaction in 98.36 per cent of the number. Excluding this 1.64 per cent of possible error, 234 carcasses, or 76.72 per cent, showed localized lesions of tuberculosis, which permitted their use for food purposes. The remaining 66, or 21.64 per cent, showed lesions of generalized tuberculosis, the entire carcasses being condemned and converted into fertilizer and other inedible products.

The appraised value of 305 reacting cattle was $13,851.10, being an average of $45.41. The proceeds of sales to butchers were $5,757.08, or an average of $18.88 per carcass. Reimbursement was made to owners on a percentage basis, the reimbursement from available funds of the Department of Agriculture being $4,264.02, an average per cow of $13.97. Owners thus received a total average of $32.85 per cow, or $12.56 less than the average appraised value.

A systematic retesting of all cattle upon premises which had shown infection at the time of the original test was started June 1, 1910, and will be continued during the coming fiscal year.

BOVINE TUBERCULOSIS UPON INDIAN RESERVATIONS.

Upon request of the Office of Indian Affairs of the Department of the Interior, the Bureau applied the tuberculin test to cattle at 31 Indian schools and reservations during the fiscal year. In compliance with a further request from the Department of the Interior, a systematic inspection and the tuberculin testing of cattle at all Indian schools and reservations will be conducted during the coming year. Tuberculous cattle will be disposed of under the supervision of this Bureau, and general improvement in the construction of buildings and in sanitation, equipment, and methods of handling milk will receive attention.

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LIVE-STOCK DISEASES AND CONDITIONS IN PORTO RICO.

During the past fiscal year investigations of the diseases of live stock and the education of native Porto Ricans to the importance of combating the communicable diseases of animals have been conducted by Dr. Thomas A. Allen, Bureau inspector in Porto Rico. Little or no action has yet been taken toward the eradication of the cattle fever tick, which infests the native cattle, particularly those of the hill country. Blackleg has continued to be an extensive disease of cattle, and is gradually being combated by the use of Bureau vaccine. Mycotic lymphangitis and glanders have been reported among the horses of the island.

CONTROL OF ANIMAL DISEASES IN HAWAII.

The suppression and prevention of communicable diseases among animals in Hawaii is under the control of the board of commissioners of agriculture and forestry, division of animal husbandry, with Dr. Victor A. Nörgaard, territorial veterinarian and an inspector of this Bureau in charge of this work.

The isolated situation of the Hawaiian Islands, and the necessity for the introduction of new stock from the mainland, rendered the sanitary control of their introduction a matter of such importance that the territorial authorities promulgated an order effective January 1, 1910, providing for the inspection of all classes of live stock prior to landing, and requiring the mallein testing of horses and mules and the tuberculin testing of all cattle above the age of 6 months by a qualified veterinarian authorized by or under the supervision of this Bureau. As glanders made its appearance among mules after their arrival from California, a special rule requires a quarantine of twenty-one days, counting from the date of departure from California, of all horse stock arriving in the Territory from that State. For the entry of sheep, certificates by this Bureau are required stating that they are free from sheep scab and have been dipped in accordance with Bureau regulations. Swine are required to be accompanied by a certificate showing their freedom from hog cholera or swine plague and from exposure thereto.

The problems of tuberculosis and sanitary milk production were given special consideration during the past year, and on March 21, 1910, Honolulu ordinance No. 17 was passed providing for the inspection of milk and dairies and dairy cows and regulating the sale of milk, etc. Under this ordinance it is intended that the tuberculin test shall be applied to all cattle furnishing milk to Honolulu. Thirteen hundred dairy cattle have been tested, 35 per cent of which have given reactions.

LIVE-STOCK DISEASES AND CONDITIONS IN HONDURAS.

During the past year numerous applications were received from representative business men of New Orleans, La., and from cattle growers in Honduras for permission to import Honduranean cattle into the United States for beef purposes. As nothing was definitely known concerning the character and extent of animal diseases in that country, and as the Government of Honduras did not possess official

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knowledge concerning the native animal diseases, two representatives of this Bureau, Dr. William Thompson and Mr. James E. Downing, were sent to make an investigation of live-stock conditions and diseases in that country. The investigation extended from March 29 to July 7, 1910, and covered all cattle-raising portions of Honduras. Representative ranches in each cattle district were visited, the cattle carefully inspected, and inquiries made concerning any disease which might exist in such locality.

The cattle feed principally on natural pastures, which during the summer or dry season furnish a scanty subsistence. Where cultivation is practiced on the coast land and in the interior small valleys, "guinea" and "para" grass provide a plentiful forage throughout the year. Owing to the mountainous nature of the country, small streams of mountain or spring water abound practically everywhere.

The cattle of Honduras are small, slow to reach maturity, and thin-fleshed, being degenerated descendants of the cattle introduced by the early Spanish settlers. In general, no effort is made toward the improvement of cattle or live stock, and male animals are allowed to roam at will, even those cattle intended for beef not being castrated until three or four years of age. Steers four or five years old, grass fed, average about 1,000 pounds live weight, and dress 40 to 50 per cent. The estimated annual net increase among cattle is only 12 per cent, severe losses being attributed to depredations of the leopard, puma, wild cat, and other animals, and to the cattle tick.

As a result of the investigation it was determined that the cattle tick (*Margaropus annulatus*) exists throughout Honduras, and that the losses sustained from the ravages of this tick are serious, the ticks constituting the one great cattle plague of the country. The fact that for a number of years there was a continued and profitable business in the shipping of Honduranean cattle to Cuba, where the cattle-fever tick is likewise prevalent, affords confirmatory evidence not only that the tick of Honduras is the cattle-fever tick but that the cattle of that country harbor in their blood the specific organism of southern or splenetic fever. Further confirmation is afforded by a shipment of nonimmune bulls from Chicago, Ill., to Truxillo, Honduras, all but one of which died from this fever shortly after their arrival.

Blackleg was found to be especially prevalent in the districts of El Paraiso and Olancho. Anthrax, or "morina," apparently exists in various portions of the country, being most prevalent during the months of July and August. Mycotic stomatitis occurs principally toward the end of the rainy season, when vegetation is at its rankest growth. Foot-and-mouth disease and tuberculosis are unknown among cattle in Honduras. Actinomycosis is prevalent in the districts of Vallee and Choluteca. Glanders, farcy, and mycotic lymphangitis were not found among horses and mules.

Gangrenous dermatitis affects the feet of these animals, frequently causing the hoofs to drop off. The natives attribute this condition to the bite of the spider. A few cases of mange were seen in horses and mules. Special investigations were conducted to determine the presence of trypanosomiasis, with negative results. Swine, which are of the long-headed, razor-backed type, act as scavengers, and frequently through their meat convey the *Cysticercus cellulosæ* parasite to man, producing the tapeworm *Tænia solium*.

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Exportations of cattle from Honduras to Cuba were made from 1882 to within recent years. This trade has now been totally suspended, due to the complete restocking of Cuba. A small trade in Honduranean cattle is being carried on with Salvador, Guatemala, and British Honduras, and it is estimated that should there be a sufficient outlet for cattle 30,000 head of steers could be annually exported.

The presence and prevalence throughout Honduras of the cattle tick, carrying with it the specific organism of southern or splenetic fever, will prevent the importation of cattle from that country into the United States, as such importation is prohibited by section 6 of the act of Congress approved August 30, 1890.

THE PATHOLOGICAL DIVISION.

The Pathological Division, of which Dr. John R. Mohler is the chief, has continued the scientific investigation of animal diseases and other lines of work as heretofore.

LIP-AND-LEG ULCERATION OF SHEEP.

The extensive prevalence of necrobacillosis in sheep under both range and feed-lot conditions has afforded this laboratory excellent opportunities for making interesting observations relative to the causative agent and the transmissibility of the disease. In almost all cases where microscopic lesions suggested necrobacillosis the presence of the necrophorus bacillus was demonstrated either by stained smears or by rabbit inoculations. In some instances it was necessary to resort to other methods. The fact that the malignant form of this disease may arise from the mild form was demonstrated by experiments carried out in the following way: From the warty, inactive form of the disease, as often found in lambs, a pure culture of the necrosis bacilli was obtained from lesions of an inoculated rabbit. This pure culture was inoculated into a second rabbit, and the necrotic muscle from this rabbit when rubbed upon the scarified nose and lips of a wether, ewe, and buck lamb resulted in the production of typical aggravated forms of necrobacillosis. The malady was easily transmitted to healthy sheep by the inoculation of scabs from ulcers of the lips of sheep. Smears and cultures made from the lesions produced by experimental inoculations showed necrosis bacilli present in large numbers.

During the past winter inspectors at various slaughtering establishments forwarded for diagnosis cattle livers exhibiting circumscribed yellowish-gray necrotic areas. Smears from such necrotic centers showed them to contain practically a pure culture of the necrosis bacillus. Portions of these beef livers were inoculated upon the lips of sheep and produced characteristic necrotic ulcers. Smears from these necrotic ulcers were teeming with characteristic necrophorus bacilli, thus establishing the experimental transmissibility of this organism from one species of animal to another.

SWAMP FEVER OF HORSES.

The investigation of swamp fever or infectious anemia of horses has been continued. A paper dealing with this disease was published in the Twenty-fifth Annual Report of the Bureau and also as Circular

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138. From general observations it seems conclusive that aside from the presence of the virus of the disease there are certain changes in the blood of advanced cases of swamp fever that are of extreme importance, but these are of such a nature that no method has yet been devised for their accurate determination. In a broad, general way it may be said that the blood is the real seat of the trouble, and that any pathological changes observed in the circulatory system or in the visceral organs are dependent on this rather than that the lesions in the circulatory system and viscera are primary. The atrophy and weakening of the muscles of the hind quarters, causing the consequent staggering gait, undoubtedly are the result of metabolic disturbances which are inherent in the blood rather than in the muscles themselves. For the present it seems probable that as the disease progresses the animal, in spite of abundant food, a vigorous appetite, and the absence of any noticeable lesions in the alimentary tract, at first loses its ability to lay on fat, and that from this stage it draws on its body fat. This certainly points to a perverted carbohydrate metabolism, and all observations point to the blood as the chief seat of the disturbance. The body fat undergoes a serious atrophy, and this change may account for some of the edemas which are so frequently observed.

An experiment with the trypanblue treatment is still under way.

The conclusion has been reached from the results thus far obtained that natural immunity against swamp fever does exist in some horses. This immunity may be increased by repeated injections of virulent serum from which contaminations have been removed or by means of defibrinated blood.

An experimental exposure of a healthy horse which was quartered in a stall adjacent to one containing a sick horse for seven months has failed to transmit the disease. The discovery of a trypanosome in the blood of horses in Panama affected with a disease which was diagnosed as swamp fever has been reported, but our observations made in various parts of the United States do not support the results obtained by the writer of the report in question. In fact, the results have been so radically different that the question may well be asked whether both series of experiments have been made upon horses affected with the same disease, although the symptoms and lesions described in both instances resemble those of swamp fever. The equine trypanosomiasis of Panama seems to occupy an intermediate position between the swamp fever of the United States and mal de caderas of South America and to bear a very intimate relation to, if it is not identical with, the Gambian horse disease of West Africa.

CHRONIC BACTERIAL DYSENTERY.

A cow affected with chronic bacterial dysentery, or Johne's disease, was shipped to the laboratory from Pennsylvania and furnished material for further study of the disease. The diagnosis in this animal was confirmed by microscopic examination of rectal scrapings, which revealed the acid-fast organism of this disease in great numbers. The cow was kept isolated in a stable in which several chickens were exposed, in order to determine whether there exists any association between this disease in cattle and avian tuberculosis, as has been asserted by some investigators. It is obvious that such an association of chickens with an affected animal would afford a splen-

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did opportunity for transmission if such were possible. The cow died in an extremely emaciated condition about three months after her arrival, and the post-mortem examination revealed no lesions except the characteristic changes in the mucosa of the intestines. These changes were particularly marked in the ileum. The exposed chickens were killed after the death of the cow and were examined. They showed no lesions whatsoever, and mucous scrapings from different portions of the intestines failed to demonstrate the presence of acid-fast organisms. The histological examination of the affected intestines from the cow showed changes characteristic of the disease, the specific organisms being present in the mucosa and contiguous lymph glands in numerous clumps. Attempts to grow the organism on various culture media failed to give satisfactory results.

BIGHEAD OF SHEEP.

The disease of sheep known to flock masters of certain sections of the intermountain regions of the West as "bighead" has been the object of investigation in an effort to learn something of its nature and cause. On account of the fleeting character of the disease and its entire absence in certain years a good opportunity to study it has not heretofore been afforded. However, a number of cases were seen this year by a member of the staff of the Pathological Division, and it is thought that a correct insight of its nature has been obtained.

The localities where this disease is known range in altitude from 4,500 to 8,000 feet above sea level, usually on the plains and valleys between the higher ranges of mountains. Places are known in Idaho, Wyoming, and Utah where it is likely to make its appearance during any of the spring months. It is most often seen in the spring following the melting of the snows or immediately after late snowstorms at that time of the year. As indicated by its name, the chief and characteristic symptom is a very much swollen condition of the head.

A singular feature about this disease is that it is usually confined to certain bands, and that quite a number of animals are simultaneously affected. It occurs only in certain regions of the West, and with more or less yearly regularity, varying, so the stockmen claim, with climatic conditions. There appear to be very definite localities where it is looked for by herders on the trail. The soil of all these regions is of volcanic formation. The flora is also more or less similar, and the climatic conditions are likely to be very much alike.

Post-mortem examinations did not give much information as to the cause. Aside from the edematous infiltrations of the subcutaneous tissues of the head and certain alterations or destruction of the eyes nothing very abnormal was found. From the internal organs of five affected animals culture media were inoculated in an effort to isolate any disease-producing micro-organisms that might be harbored therein, but in no case was a growth obtained except from accidental contaminations from the air.

From the histories of various outbreaks of the disease, as related by a number of intelligent and observing sheep owners and from personal observations, it is certain that many views previously held as to its etiology are wrong. For instance, it does not require a storm to produce the disease; it does not require melting snows to bring on an attack; alkali water does not cause bighead in

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other parts of the West and is no more likely to produce it in these regions; and gaseous emanations probably have nothing at all to do with it, as emanations of gas have never been proven even to exist. But climatic conditions of a definite character, in combination with certain plants, probably do have the necessary influence to engender the disease, and from observations made this year it would seem that the drinking water had a contributing influence.

In reviewing the literature of plant poisoning of animals one is struck with the great similarity of this disease to that condition known as fagopyrismus, a disease of the skin and subcutaneous tissues produced by the eating of buckwheat, but requiring the direct rays of the sun to act in conjunction therewith. With this idea in view, an opportunity was afforded at Christianburg, Utah, to put this theory to a test, at least so far as the atmospheric conditions are concerned. In less than two hours three different bands of sheep, 3 to 5 miles apart, all exposed to the same atmospheric conditions and grazing on the same kinds of plants, developed many cases of bighead. All of them had been watered that morning in the Sevier River or in the irrigation ditches flowing from that river. The first band to water and the one farthest away from the stream at the time the sun began to operate had the largest number of sheep affected. This band of sheep had been shorn and was being hurried along on its way to the home lambing grounds. The other two bands were not yet shorn and were being moved more slowly. Several other bands subjected to very nearly the exact conditions on other days developed cases of bighead.

It seems probable that poisonous properties in a certain plant or plants, in combination with certain conditions, may be the causative agent of the disease, and several plants are now under investigation.

GLANDERS.

A great number of specimens, principally nasal swabs, from suspected cases of glanders have been received at the laboratory for diagnosis. The usual bacteriological methods were employed for the determination of the disease.

Besides these routine examinations of suspected cases, experiments were conducted by which an early and reliable diagnosis of latent cases of glanders could be made. In many glandered horses the clinical symptoms of the disease are manifested only at a late stage or not at all, and such unsuspected latent cases must be considered as dangerous in spreading the disease. The mallein and agglutination tests both have their deficiencies, and a more reliable method of detecting incipient and latent cases is very desirable. Following the suggestion of a European correspondent, the Bureau is conducting experiments with a precipitation method for the diagnosis of glanders, and the results so far obtained are exceedingly promising and indicate that with its aid an early diagnosis of suspected cases will be possible not only in laboratories but in the field as well.

ANTHRAX.

In controlling outbreaks of anthrax it is the general practice to use Pasteur vaccines for the purpose of preventing the spread of the in-

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fection. As this method requires about one month in which to establish protection, efforts have been made to shorten this period by the use of certain laboratory products which consist of a vaccine requiring only one application and an antibacterial serum. In a general way favorable results were obtained in experimental rabbits by the use of certain substances precipitated from nondialyzed cultures, but these all failed when applied to the larger animals. Likewise, an autogenic vaccine had no effect when tested against virulent bacilli.

Numerous experiments have shown, however, that an immediate passive immunity can be conferred by the use of blood from a highly immunized animal, one which will resist five thousand times the minimal lethal dose of the most virulent strains of anthrax bacilli; also that simultaneous injections of the most virulent strains of bacilli, or of attenuated bacilli, and such a serum, confer an active immunity. Hence by the use of this method an existing outbreak can be checked, or the disease can be prevented, as by the ordinary vaccines. As the serum confers immediate passive immunity, it is not deemed wise to employ virulent bacilli for producing the active immunity, but it is safer to inject simultaneously with the serum the usual Pasteur vaccines, or a single vaccine which corresponds in strength to the No. 2 Pasteur vaccine.

BLACKLEG VACCINE.

During the fiscal year ended June 30, 1910, the Pathological Division prepared and distributed among stock raisers about 1,000,000 doses of blackleg vaccine. The high standard of efficiency of the vaccine prepared by this Bureau has been maintained, as is shown by reports made by the stock raisers who have used the vaccine. Reports on vaccine distributed during the fiscal year ended June 30, 1909, show that out of 578,996 cattle reported as vaccinated only 2,242 (0.38 per cent) died. Comparison with previous reports shows a material decrease in the losses from this disease before vaccination, and also a slight decrease in the percentage of losses after vaccination.

RABIES.

Rabid animals have continued to arrive at the laboratory for examination during the year in but slightly decreased numbers from those received during the year before. The number of positive cases received each month shows that the infection has been constantly present in animals of the infected localities.

During the year 116 cases have been examined, consisting of 100 dogs, 7 cattle, 6 cats, 2 mules, and 1 sheep, which had bitten at least 59 persons and 46 animals. Other animals may have been bitten of which no record was made, as a rabid dog in his wanderings across the country is liable to snap at every animal that he may chance to meet, and in many instances these attacks escape observation, yet these are the cases which perpetuate the disease among the dogs of the infected regions. Of the 116 suspected cases examined, 75 were found to be positive. The following table gives data regarding these positive cases. It will be seen that 58 of these cases came from the District of Columbia.

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Positive cases of rabies diagnosed by the Bureau of Animal Industry during the fiscal year 1910.

Date.	Record No.	Animal.	Source.	Persons or animals bitten.
1909.				
July 7	3209	Dog	District of Columbia	None reported.
9	3210	do	do	Several animals.
23	3232	do	do	1 boy.
Aug. 13	3258	do	Virginia	1 woman.
16	3262	do	District of Columbia	None reported.
16	3264	do	do	Do.
19	3274	do	do	1 boy.
25	3285	do	do	3 people.
Sept. 8	3301	do	do	1 dog.
13	3309	do	do	None reported.
15	3314	do	Tennessee	Do.
16	3320	do	District of Columbia	1 man.
22	3329	do	do	None reported.
22	3330	Cow	Indiana	Do.
30	3341	Cat	District of Columbia	2 persons.
Oct. 1	3344	Dog	do	None reported.
1	3348	do	do	1 man.
8	3361	do	do	Do.
9	3365	do	do	None reported.
Nov. 9	3433	do	do	Do.
15	3445	do	do	Do.
15	3446	do	West Virginia	1 child.
23	3466	do	District of Columbia	1 man.
Dec. 6	3493	do	do	None reported.
11	3505	do	do	Do.
21	3514	do	do	2 men.
22	3518	do	West Virginia	1 woman.
22	3520	do	District of Columbia	Do.
29	3526	do	do	1 man.
1910.				
Jan. 3	3543	do	do	None reported.
8	3548	do	do	1 girl.
12	3559	do	do	2 persons.
12	3560	do	do	None reporetd.
13	3564	do	do	11 dogs, 1 cow.
13	3565	Cat	do	1 child.
17	3568	Dog	do	None reported.
19	3574	do	do	2 persons, 2 dogs.
22	3582	do	Colorado	None reported.
24	3589	do	District of Columbia	2 persons.
24	3591	do	West Virginia	2 persons and a number of dogs.
Feb. 2	3611	do	District of Columbia	1 dog.
7	3618	do	do	1 woman, several dogs.
9	3625	do	do	1 boy.
16	3636	Cow	West Virginia	None reported.
23	3656	Dog	Virginia	Do.
Mar. 8	3678	Mule	do	1 man.
10	3685	Dog	District of Columbia	1 dog.
15	3691	do	do	None reported.
16	3693	do	do	1 man.
17	3697	Cat	do	Do.
17	3698	Dog	do	None reported.
19	3705	do	Maryland	1 man.
25	3711	do	District of Columbia	None reported.
28	3715	Steer	Missouri	Do.
Apr. 4	3724	Dog	District of Columbia	Do.
11	3737	do	do	1 man.
11	3738	Cow	Maryland	None reported.
13	3743	Dog	District of Columbia	2 dogs.
21	3756	do	do	1 woman.
22	3757	do	do	None reported.
28	3767	do	do	Do.
May 6	3778	do	do	Do.
10	3785	do	do	Do.
11	3788	do	Tennessee	1 child.
12	3791	do	District of Columbia	None reported.
14	3797	do	do	Several dogs.
16	3798	do	Virginia	Several cattle.
20	3810	do	District of Columbia	3 dogs.
24	3822	do	do	1 boy.
31	3830	do	do	None reported.
June 4	3845	do	do	2 or 3 dogs.
18	3855	do	Texas	None reported.
20	3857	do	District of Columbia	1 boy.
21	3859	do	Tennessee	2 children.
29	3872	do	District of Columbia	Several dogs.

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The diagnosis of rabies in the suspected animals received at the laboratory has been made, so far as possible, by the demonstration of Negri bodies. This method of examination is proving to be very satisfactory, and is used at present in most pathological laboratories where rabies investigations are made.

It is of interest to learn that rabies has been so completely eradicated from Great Britain by the enforcement of muzzling regulations that the pathologists of that country were obliged to send to this country for material from which to make a study of Negri bodies when the discovery was made that the latter bore a most intimate relation to the transmission and development of rabies.

DISEASES OF POULTRY AND OTHER BIRDS.

Routine work has related to the ordinary diseases noted in previous reports. The recent claims of European investigators as to the ultramicroscopic character and identity of the causal agent in so-called chicken diphtheria (roup) and epithelioma contagiosum (chicken pox) give interest to the laboratory findings in certain outbreaks during the past year. In a severe outbreak that occurred among a flock of Game chickens there were found in all the birds, in stained smears from the necrotic material from mouth, nose, and eye, great numbers of short, medium, and long-beaded filaments of *Bacillus necrophorus*. Isolated in pure culture and inoculated on the scarified buccal mucous membrane of healthy chickens, there resulted only a passing necrotic patch which vanished in several days. Associated with the necrophorus bacillus in this disease was the polar-stained hemorrhagic septicemia organism *Bacterium avicida*, the recognized cause of fowl cholera. So virulent was this organism that necrotic material inoculated subcutaneously into rabbits resulted in death in three days, and the cultivation of the bacterium from the heart blood, liver, and spleen, readily followed. The site of inoculation was marked by caseo-necrotic material presenting the well-known characteristics of necrobacillosis, although manifestly in such time there could be no typical development of the "necrophorus" lesion. Pure cultures of *Bacterium avicida* inoculated upon the scarified buccal mucous membrane of healthy chickens resulted in a thin yellowish scab and death in three days.

Another outbreak affected almost exclusively the chicks, but two adult birds being attacked. The disease manifested itself by the production of large, dry, cheesy nodules at the base of the comb, about the eyes and angles of the mouth, and on the larynx. The necrotic material in these cases, whether examined in the fresh state or in stained smears, revealed large numbers of coccidial schizonts. All chickens autopsied showed marked evidences of intestinal coccidiosis, while some presented the hepatic form recognized as the blackhead disease.

TUBERCULOSIS.

Tuberculosis has lost none of its importance to the people of the country, and recognizing this fact, the Pathological Division has continued its investigations into questions related to its diagnosis and eradication.

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One of the most important branches of this work has been concerned with the production of immunity in cattle. It is very evident that the power to immunize cattle safely against all tuberculous attacks would afford the greatest possible assistance wherever attempts were made to eradicate the disease, as all of the healthy animals could receive immunizing treatment and the diseased portion of the herd could be destroyed or quarantined. The experiments necessary for the establishment of any satisfactory conclusions in a study of this character must extend over a long period of time, and tests must be made upon many animals of different ages and conditions before any definite conclusions can be reached. While no method of vaccination has yet been devised whereby cattle may be fortified against attacks of tubercular infection under all circumstances, still it has been shown by the cooperative investigations of the Experiment Station and the Pathological Division that their resistance may be materially increased by means of suitable inoculations.

In some of the rare cases in which cattle giving a reaction to tuberculin did not disclose any macroscopic lesions of tuberculosis when submitted to post-mortem examination, glands from the cattle in question have been sent to this laboratory and tested by microscopic examinations or animal inoculations so as to determine the presence or absence of tubercle bacilli. In more than half of such examinations tubercle bacilli have been positively identified when the tissues have been closely examined by laboratory methods, thus showing that tuberculosis was really present in these carcasses, but in the most incipient form. This also shows that the diagnoses given by tuberculin are in reality even more accurate than is indicated by ordinary post-mortem examinations of reacting animals.

EXAMINATION OF MILK.

The question of the presence of tubercle bacilli in market milk has also received careful attention. Milk from the cities of Chicago, Philadelphia, and Washington has been examined at the laboratories of the Bureau in each of the above-named cities for the purpose of determining what percentage of the samples tested contained virulent tubercle bacilli. The general bacterial content of these samples was also ascertained.

In Chicago the work of testing milk has been carried on in cooperation with the city department of health. Up to the end of the fiscal year 173 samples of raw milk, 44 samples of pasteurized milk, and 10 samples of certified milk had been submitted to examination. No deductions have yet been made relative to the presence of tubercle bacilli in the pasteurized or certified samples, as the inoculation tests have not yet been concluded.

Two hundred laboratory animals were inoculated with raw milk, one animal being used for each sample of milk. A mixture of cream and sediment from the bottom of the centrifugalizing tubes was inoculated subcutaneously in each case. One case of tuberculosis was found, and this sample was traced to the farm where the milk was produced. Twenty-six cows were furnishing the milk from this place. By consent of the owner the tuberculin test was applied to all of these cows, and 3 of them gave a positive reaction for tuberculosis.

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At the Philadelphia laboratory 150 samples of raw, pasteurized, and supposedly pasteurized milk, purchased from various milk stores in approximately all parts of the city, were tested. The samples collected were placed in sterile bottles and brought immediately to the laboratory. A microscopic examination and animal inoculations were made from each sample. Three guinea pigs were inoculated subcutaneously from each sample, one receiving cream, one sediment, and the other a mixture of cream and sediment. All animals were kept under observation for two months after inoculation, and at the expiration of this time a careful autopsy was made upon each animal. The autopsies showed that 20 of the samples, or 13.3 per cent, contained active germs of tuberculosis. Microscopic examinations were in all cases negative or indefinite. The examination of the different parts of each sample showed that the cream contained a larger percentage of tubercle bacilli than the sediment. An examination of each sample was also made for the percentage of fat, acid, total solids, the specific gravity, and leucocytic and bacterial content. These examinations showed that much of the milk was of a poor quality.

In the city of Washington the previous work of the Pathological Division showed 2 samples of tuberculous milk out of 73 specimens examined. During the past year examinations were mainly limited to samples from milk sold by dealers who claimed that the product was pasteurized, or that it had been obained from cows that had passed the tuberculin test without giving any evidence of tuberculous infection. Of about 40 samples, only one was found which contained living tubercle bacilli, and this milk came from an untested herd outside the District of Columbia. This result was very gratifying in view of the large amount of work recently done in testing with tuberculin the cows in the District of Columbia as well as the many large herds outside of the District limits, whose milk is sold to consumers in Washington. These samples of milk were also examined for the number of leucocytes and bacteria, and in this regard a very satisfactory showing was also made.

EXAMINATION OF "BOB VEAL."

On several occasions recently the Bureau's attention has been directed to the practice of certain butchers of placing on the market as edible veal the flesh of immature calves. In view of this practice it is considered very important that more definite information be obtained relative to the age at which calves may be properly slaughtered for veal. Investigations have therefore been started for the purpose of testing the flesh of calves of various ages to see if any harmful properties are present, also to establish the degree in which its tissues are deficient in nutritive value.

INVESTIGATIONS OF COTTON-SEED MEAL.

Laboratory work has demonstrated the presence of pyrophosphoric acid in certain cotton-seed meals, and feeding experiments with a simple combination of this acid, such as sodium pyrophosphate, have shown that an amount of this salt which would correspond to even less than would be present in 1 pound of the meal will, if given daily, induce in pigs symptoms closely resembling those seen after feeding

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cotton-seed meal that has been made from the seeds of certain varieties of cotton plants. The pathological lesions thus obtained resemble very closely those seen after similar feeding with such meals. There were only slight quantitative differences. No doubt the base with which this acid is combined in the meal may contribute somewhat to this injurious action.

From the findings of laboratory investigation it seems that cotton seeds vary much in their toxicity. Some are practically nontoxic in their character, but if during the manufacture of meal from the seeds a high temperature is applied to them a poisonous principle may develop. Work is in progress on the identification of the bases with which pyrophosphoric acid is combined. It is important that certain features of this work be repeated under factory conditions.

THE BIOCHEMIC DIVISION.

The Biochemic Division, of which Dr. M. Dorset is the chief, has been engaged during the year chiefly in the laboratory work incident to the meat inspection, in laboratory research work relating to meat products, in investigations concerning hog cholera, in making tests of stock dips, and in preparing and distributing tuberculin and mallein.

LABORATORY MEAT INSPECTION.

The laboratory meat inspection during the past year has been carried out along the same general lines that were followed previously, though the organization of the work has been improved, and the various meat-inspection laboratories have been assigned definite territory, which they are expected to cover, examining samples of all products at reasonable intervals.

During the fiscal year a total of 19,580 samples were examined by the laboratories. These samples consisted of meat food products, salt, spices, condiments, colors, and substances used in the preparation of meats and meat products. Approximately 80 per cent of these samples were from establishments at which inspection is maintained, the remainder being from establishments operating under certificates of exemption.

The results of the year's work show that the use of prohibited preservatives has been practically discontinued in inspected establishments. Certainly is this true in the case of the larger establishments. Boric acid was found in only 8 samples (sausages), no other preservative being used.

In regard to the adulteration of meat food products from inspected establishments, it has been found that a considerable percentage of sausages contained cereal without this fact being stated on the label. In many instances this is due to ignorance of the packer who uses a proprietary seasoning mixture which frequently consists largely of some cereal flour. In the case of fats and oils, the lards are practically the only products which were found to be adulterated, and these cases of adulteration were extremely rare. In such instances the adulteration sometimes consisted simply in the presence of a minute amount of cotton-seed oil (less than 1 per cent), this arising in many cases from the use of the same pipes and equipment for preparing lard and lard substitutes, the latter normally containing cotton-seed oil.

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The laboratories have examined a large number of coloring materials offered for use in coloring sausage casings and rendered fats. The great majority of coloring materials offered in this way have been rejected on account of the presence of arsenic, it having been decided that no coloring matter should be used on meat food products which contained more arsenic than 1 part in 700,000 of the coloring substance.

A number of inspections have been made of meat food products in order to determine their wholesomeness. This examination applied mainly to the rancidity of fats and oils and to the wholesomeness of certain supected samples of canned meats. Inspectors have been instructed that in all cases "blown" or "puffed" cans of meat food products should be condemned, the puffing of the cans being due in all cases to the development of bacteria within the can after the process of canning was completed.

During the fiscal year 115 sanitary examinations of packing-house water supplies have been made. The results of these examinations have been to prohibit the use in or on meats or meat food products of 15 water supplies which were found to be of questionable wholesomeness.

RESEARCH WORK ON MEAT PRODUCTS.

The research work in connection with the laboratory meat inspection has consisted in part of the study of existing methods of analysis, in order that these might be improved where possible and that the effect of interfering factors might be more thoroughly understood. In addition, a number of questions arising in connection with the enforcement of the meat-inspection law have been given special study.

A general study has been made of the rancidity of fats and the changes which accompany the development of this condition. The general work is far from completed, but opportunity has been afforded for a study of the effect of rancidity on various routine tests which are applied to fats in the course of a laboratory inspection. The Kreis test for rancidity has been studied considerably, and it has been found that it is a reliable indicator of rancidity, but so exceedingly delicate that a certain amount of caution and judgment must be used in drawing conclusions from it. The Halphen test for cotton-seed oil has been found to be weakened and the iodin number of fats reduced by the development of rancidity, thus confirming previous observations. The effect of rancidity on the percentage of free fatty acids appears to be in the nature of a reduction at first, and later, after the fat has become strongly rancid, the proportion of free fatty acid increases. The phytosterol test is rendered unreliable by the development of rancidity.

Soy-bean oil is now being used in the preparation of meat food products, especially oleomargarin. A study of the pure oil has been undertaken, but is not yet completed. Enough has been accomplished, however, to enable the laboratories to deal with any attempt to use this oil as an adulterant. Considerable study has also been given to the coloring matter contained in the soy-bean oil. The coloring matter has been separated from the oil and a study made of its chemical properties.

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A thorough chemical study of the fat of hogs fed upon cotton-seed meal has been made, and a report is being prepared for publication. The general results of the work showed that the fat of hogs fed on large quantities of cotton-seed meal is abnormally soft and abnormally rich in the glycerids of the unsaturated fatty acids. In confirmation of work carried out by previous investigators the fat of these hogs was found to give the Halphen and Becchi tests for cotton-seed oil, but it does not contain phytosterol, thus permitting ready distinction between the fat of this character and fat to which cotton-seed oil has been added.

The investigations concerning meat extracts, referred to in my report for the previous year, have been continued and have resulted in the adoption of definite rules governing the preparation of meat extracts at establishments at which federal inspection is maintained.

An investigation of the action of fats and oils on metals was undertaken primarily in order to determine the effect of fats and oils on galvanized iron, which has been in the past used extensively for constructing containers for lards and lard substitutes and has also been used for lining oleo seeding trucks and for making baker's drums and similar metallic receptacles. As a result of this investigation it was found that practically all metals, zinc in particular, are attacked by fats and oils, and the use of zinc-coated vessels as permanent containers for meat or meat food products in establishments operating under federal inspection has been prohibited. The results of this study have been prepared for publication in the Twenty-sixth Annual Report of the Bureau. This study is being extended to include the effect of meat food products in general upon metallic containers. An investigation of solders and fluxes now used in the manufacture and sealing of metallic containers for meat food products, together with a study of the paints used for coating cans, is now under way.

In view of the large number of permitted coal-tar colors offered for use in coloring the casings of sausages, it has been necessary to secure a satisfactory method for estimating any poisonous ingredients in these colors. It has been found that arsenic is practically the only poisonous substance which may contaminate these colors, provided the colors themselves are pure. An extensive examination of this question has resulted in the adoption of a modified Gutzeit test which has enabled the analyst to determine the arsenic with a satisfactory degree of accuracy.

In my last report it was mentioned that the cause of the souring of meats during curing was being studied. This work has been completed and a report of it prepared for publication. The investigations have shown that the souring of meat is due to the action of a specific spore-bearing organism which is properly classified among the so-called anaerobic putrefactive bacteria. In the paper which is to be published a description of this organism is given and suggestions are made which it is hoped will lead to a diminution of the percentage of sour meats heretofore occurring in inspected establishments.

An investigation to determine the effect of prolonged storage on canned meats was begun during the fiscal year. A large number of cans of corned beef, roast beef, and lunch tongue were prepared at one of the large packing establishments. A chemical, histological, and bacteriological study of certain of these cans was made shortly after

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preparation, and the remainder are being held for examination after the lapse of different intervals of time. It is hoped by this study to determine whether or not any undesirable change takes place in canned meats after the lapse of a number of years.

During the past fiscal year the cooperation of the Biological Survey of the Department was secured in a study of the problem of ridding packing houses of rats, and an expert of that Bureau visited a number of large establishments at National Stock Yards and Chicago, Ill. A report of his investigation has been used as a basis for instructions to inspectors as to measures to be adopted to destroy and exclude rats.

BRANDING INK.

A systematic effort has been made during the year to improve the branding of inspected meats. A study of branding meats has been made at a large number of the meat-inspection stations, and the result has been to increase materially the efficiency of the marking. During the year 4,137 gallons of branding ink prepared by the Biochemic Division were shipped to inspectors in charge of meat inspection. The total cost of the ink, including materials, labor, and containers for shipment, was $2,373.50.

DIPS AND DISINFECTANTS.

The work on dips and disinfectants during the past year has consisted of (1) routine examination of substances used or offered for use in official dipping, and (2) special or research work.

The routine work has consisted in the examination of samples submitted by manufacturers, in the examination of samples of permitted dips which have been sent in by field inspectors, and in the examination of samples of disinfectants for the general supply committee for government departments located in Washington. A comparatively small number of samples of new preparations offered for use in official dippings have been submitted by manufacturers during the year.

Laboratory experiments in the preparation of a concentrated arsenical dip for the use of the Bureau employees in the work of tick eradication resulted in securing a dip which possessed the necessary qualities in so far as the solution itself was concerned, and larger quantities were sent to the field for trial. These field experiments are not completed, but the indications are that the preparation will be satisfactory.

A chemical and bacteriological study of phenolic disinfectants, begun during the previous year, has been continued, but is not yet completed, although decided progress has been made.

Several cases of injury to sheep following dipping in coal-tar creosote and cresol dips were reported during the year, and as the cause of the injuries was not apparent from the reports received, a special detail of a veterinarian and a chemist was made to investigate the cases of injury and study the question at dipping centers where losses had occurred. The results of this investigation indicate that loss after dipping is usually caused by the combined action of a number of different influences, such as the condition of the sheep, the dip, and the handling of the sheep after dipping. If the sheep are un-

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thrifty and weak, either as a result of poor feed or hardship during shipment, they may not be able to stand dipping in a solution which would be entirely without effect on perfectly strong and healthy animals. If the dip is imperfectly mixed, if it is prepared in such a way that it tends to separate or "break," if it is too warm, or if the sheep are kept in too long, injury may result. Generally, however, these factors will not cause serious loss in healthy sheep unless there is a marked "break" or separation of the dip, in which case there is a separation and concentration of the irritating part of the dip. If the sheep have been driven long distances, or subjected to physical hardships, loss is more apt to follow than in those which have not been subjected to such treatment. The above facts lead inevitably to the conclusion that in dipping sheep it is essential to perform all operations with extreme care and accuracy.

HOG CHOLERA.

The work in connection with hog cholera has been along the same lines as those pursued during the preceding year, the efforts of the Bureau being directed chiefly toward assisting state officials in beginning the work of producing serum for immunizing hogs against hog cholera according to the method successfully developed by the Bureau. This has been done through advice by letter and by explaining to state representatives personally at the Bureau's experiment farm at Ames, Iowa, the methods of producing the serum and in furnishing a limited amount of serum and a few immune hogs to States that were just starting the work. In addition, a limited number of practical demonstrations have been carried out successfully in Maryland, Virginia, Illinois, Missouri, Iowa, Kansas, Kentucky, and Tennessee. Most of these demonstration experiments consisted in treating a part of a diseased herd and leaving the remainder untreated. At Kansas City, Mo., however, a more thorough test was carried out, the results of which were so interesting and demonstrated so conclusively the efficiency of the serum as a preventive for hog cholera that an outline of it seems desirable.

The test was made in the stock yards at Kansas City, upon the request of the Kansas City Live-Stock Exchange and of individuals interested in this subject. Thirty-five young shoats were purchased from a farm where hog cholera had not existed. These pigs, having been carried to the Kansas City stock yards, and being in charge of a committee appointed by the exchange, were treated as follows: Twenty-two were injected with anti-hog-cholera serum prepared by the Bureau. Four were injected with virulent hog-cholera blood. Nine were not treated in any manner. All were placed in a pen together. As was expected, the 4 pigs inoculated with the virulent blood contracted hog cholera within a short time and all died. The 9 "checks" contracted hog cholera from those which were inoculated with hog-cholera blood, and they also died. The 22 pigs treated with the serum remained well, with the exception of one or two, which were slightly affected on one or two days. It is not certain, however, that the trouble with the immune hogs was hog cholera, as none died. All of the autopsies on the check animals

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showed typical lesions of hog cholera. No more convincing proof of the efficacy of this serum could be obtained than is afforded by this experiment.

A considerable amount of experimental work concerning hog cholera has been carried out as opportunity offered. In the previous annual report it was stated that carbolic acid, even in considerable concentration, did not destroy the virulence of hog-cholera blood, although it was sufficient to destroy the ordinary forms of bacteria which are at times present in such blood as contaminations. It was considered desirable to eliminate these foreign bacteria in blood to be used for inoculation simultaneously with the serum, and experiments were carried out with that idea in view. The experiments showed that it was perfectly feasible to protect hogs completely from hog cholera, probably for life, by injecting them simultaneously with carbolized hog-cholera blood and anti-hog-cholera serum. It is believed that the use of carbolized hog-cholera blood in connection with the serum will be of distinct advantage when simultaneous inoculations are carried out.

Experiments have shown that the virus of hog cholera is not destroyed by a 2 per cent solution of carbolic acid, even after contact with the disinfectant for two weeks. The practical effect of this is to indicate that carbolic acid should not be used as a disinfectant in the outbreaks of hog cholera, but should be replaced by "liquor cresolis compositus" (U. S. P.) in a 3 per cent solution.

The Kansas State Agricultural Experiment Station has published bulletins indicating that it had used with some success as a vaccinating agent blood from a horse which had been injected with hog-cholera blood, it being supposed that the residence of the virus of hog cholera in the body of the horse brought an attenuation of the virus, and that the inoculation with this horse blood, drawn at a given time after inoculation, conferred an active immunity upon the injected hog. The Bureau undertook to test this point, and while our experiments have been carried out with only one horse, the results were entirely negative, and it was not considered that we were warranted in pursuing this line of experiment further. We have likewise failed to procure a potent serum by injecting horses with blood taken from hogs sick of hog cholera.

Efforts to determine the nature of the pathogenic agent present in the blood of sick hogs and responsible for hog cholera have been continued, but no positive conclusions have been reached.

TUBERCULIN AND MALLEIN.

Tuberculin for the diagnosis of tuberculosis in cattle was prepared and sent out during the fiscal year to the amount of 349,272 doses, an increase of more than 38 per cent over the amount distributed the year previous. This is undoubtedly due to the increased interest which health officials are showing in the subject of tuberculosis, and also to their recognition of the fact that the tuberculous cow is a serious menace to public health. The tuberculin was distributed to state, county, and municipal officials.

Mallein to the amount of 73,346 doses, for the diagnosis of glanders in horses, was also prepared and distributed.

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THE ZOOLOGICAL DIVISION.

The Zoological Division, of which Dr. B. H. Ransom is the chief, has continued the investigation of animal diseases of parasitic origin and the study, collection, and determination of animal parasites.

ROUNDWORMS IN SHEEP.

The investigations relative to stomach worms and other roundworms parasitic in sheep have been continued. No new facts of importance bearing on the life history of these parasites, their prevention or treatment, have been discovered.

A zoological study of all the roundworms parasitic in the alimentary tract of ruminants has been completed and prepared for publication. Including newly discovered species, the different kinds of roundworms occurring parasitic in the alimentary tract of ruminants are about 50 in number, and 33 of these have been found in the United States.

GID IN SHEEP.

The first part of a comprehensive study of the gid disease of sheep and the parasite which causes it has been completed and the manuscript sent to the printer. Except for rare cases the disease as yet appears to be limited to the State of Montana, and it is enzootic only in the northern half of that State.

A common opinion that dogs do not eat the brains of sheep because of inability to break through the skull, and hence that the infection of dogs could not come from eating the brains of infested sheep, was proved by experiment to be incorrect. It was found that dogs of the size of an ordinary sheep dog readily extract the brain from sheep skulls, and also that they may in some cases devour nearly the entire bony part of the skull. A report of these experiments is given in Bureau Circular 159.

SHEEP SCAB.

A compilation of reports made by Bureau inspectors as to the results of dipping sheep under federal supervision during the calendar year 1909 indicates that lime-and-sulphur and tobacco-and-sulphur dips were much more efficacious than coal-tar creosote and cresol dips. These results are similar to those obtained from a compilation of the reports by sheep owners of dippings done during the calendar year 1908. In both instances, however, the number of dippings in coal-tar creosote and cresol dips of which reports were received was rather small, so that it would perhaps be unfair to conclude that these classes of dips are generally less efficacious than lime-and-sulphur and tobacco-and-sulphur dips. Nevertheless the reports suggest that the opinion that the former classes of dips are less reliable than the latter as remedies for sheep scab is not without foundation.

In cooperation with the Kentucky Agricultural Experiment Station a series of experiments in the treatment of sheep scab with tobacco dips was carried out, in order to obtain information as to the effect of the omission of sulphur upon the efficacy of these dips.

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These experiments showed that tobacco dips without sulphur will cure sheep scab. Whether sulphur may safely be omitted in actual practice remains to be determined.

CATTLE MANGE.

Two series of experiments in the treatment of cattle mange by means of a single application of a kerosene-soap preparation were conducted under the immediate direction of Dr. W. E. Howe, of this Bureau. The dip was apparently successful in one series. In the other series it failed to cure all of the cattle in the experiments. It is planned to try the dip again during the coming year, using a higher percentage of kerosene.

Observations were made in Texas indicating that two dippings in an arsenical dip containing an equivalent of about 8 pounds of arsenic trioxid to 500 gallons of dip are insufficient for the cure of cattle mange.

INVESTIGATIONS RELATIVE TO TICK ERADICATION.

A bulletin including the results of two years' investigations relative to the life history of the cattle tick and other points bearing on tick eradication, which were conducted in cooperation with the veterinary department of the Alabama Polytechnic Institute, has been prepared for publication.

Farmers' Bulletin 378, on methods of exterminating the cattle tick, was issued during the year.

A bulletin including the results of several years' investigations of arsenical dips as remedies for cattle ticks has been prepared. In this bulletin it is shown that an arsenical dip containing an equivalent of 10 pounds of arsenic trioxid, 25 pounds of sal soda, and 1 gallon of pine tar to each 500 gallons of dip may be effectively used to free cattle from ticks, provided two dippings are given at an interval of from seven to ten days.

An investigation of a proprietary arsenical dip containing on dilution an equivalent of about 8 pounds of arsenic trioxid to each 500 gallons showed that cattle could be almost entirely freed from ticks by two dippings at an interval of ten days.

In April, 1910, under supervision of an inspector of this Bureau, about 2,000 cattle were dipped twice at an interval of seven to ten days in an arsenic, soda, and pine-tar mixture, containing an equivalent of 10 pounds of arsenic trioxid to each 500 gallons of dip. Two days after the second dipping a few of these cattle were found to be still infested with ticks. An investigation of this dipping was made. The failure to free the cattle entirely from ticks may be explained as probably due to the fact that the cattle were dipped in a short vat. Many of the cattle had not shed their winter coats of hair, and a thorough wetting of the body was not insured in passing through the bath on account of the shortness of the vat; hence it is not certain that all of the ticks with which they were infested were exposed to the action of the dip. In the light of this experience it is considered advisable that vats less than 40 feet in length at the surface of the dip should not be used for dipping cattle in arsenical dips.

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Experiments are now in progress, under the immediate direction of Dr. E. M. Nighbert, of this Bureau, with an arsenical dip prepared in concentrated form by the Biochemic Division. A preliminary report indicates that this dip will prove satisfactory in the treatment of cattle for ticks, but a definite statement as to its efficacy can not be made at this time.

INVESTIGATIONS CONCERNING PARASITIC PROTOZOA.

Bureau Bulletin 119, issued during the year, contains the results of investigations concerning certain constituents of normal blood, liable to be confused with parasitic organisms, a preliminary report on a trypanosome (*Trypanosoma americanum*) commonly present in American cattle, and data relative to certain other parasitic protozoa.

Investigations relative to the Texas-fever organism have been continued.

INDEX-CATALOGUE OF MEDICAL AND VETERINARY ZOOLOGY.

Parts 24, 25, and 26 of the Index-Catalogue of Medical and Veterinary Zoology have been issued during the year. This catalogue is being prepared under cooperation between the Zoological Division of this Bureau and the Division of Zoology of the Hygienic Laboratory of the United States Public Health and Marine-Hospital Service, the Department of Agriculture publishing the author index and the Treasury Department the subject index. Unless unforeseen circumstances prevent, the publication of the author index will be completed during the coming year.

COLLECTION OF PARASITES.

Many new specimens have been added to the collection of parasites belonging to the Bureau.

Numerous autopsies on various animals, wild and domesticated, were performed during the year for the purpose of determining the presence or absence of parasitic infestation and the relation of the presence of parasites to the cause of death.

MISCELLANEOUS WORK.

A disease among sheep reported from North Carolina was investigated and found to be due to roundworm infestation of the alimentary tract and lungs.

Losses among a herd of young horses in Virginia during the spring of 1910 were investigated, and the trouble was found to be due apparently to a heavy infestation with lice and roundworms and to insufficient food.

The usual amount of correspondence relative to parasitic diseases and the identification of specimens of parasites was received and replied to.

THE EXPERIMENT STATION.

The general character of the work at the Bureau's Experiment Station at Bethesda, Md., in charge of Dr. E. C. Schroeder, superintendent, has been similar during the past fiscal year to that of former years, consisting of independent investigations, investigations in

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cooperation with other divisions of the Bureau, and the provision of facilities for the other divisions to make investigations of a kind that require farm and field conditions not obtainable within the limits of the city. As indicated elsewhere, the new Beltsville farm will provide facilities for experimental work in animal husbandry and dairying, and the work at Bethesda will probably be confined hereafter to veterinary investigations.

TUBERCULOSIS INVESTIGATIONS.

The most important investigations made during the past year related to tuberculosis. An experiment to determine the value of various methods of immunizing cattle against tuberculosis, begun several years ago, was continued and is now about complete. It was found that the methods of so-called bovo-vaccination, devised by Pearson in America and Von Behring in Europe, actually confer a considerable degree of immunity on the treated animals; not an absolute immunity, but an undeniable increased resistance to infection with tuberculosis, which holds out great hope for the results that may be obtained with investigations in the future. At present, however, the extensive use of these methods for conferring immunity can not be recommended, as our knowledge about the latency of tubercle bacilli in the animal body, the channels through which the elimination of tubercle bacilli from the bodies of animals into which they are injected for protective purposes occurs, etc., is insufficient to enable us to draw the conclusion that the practice of bovo-vaccination is free from danger to the herds to which it is applied, and, what is of greater importance, free from danger for the persons who use the products derived from the vaccinated cattle. As living tubercle bacilli are employed in all the systems of bovo-vaccination which have, as far as they have been tested at the Experiment Station, given any proof that they are capable of protecting against tuberculosis infection, and as the use of such bacilli can not be regarded as free from danger, it seems that an ideal system of immunization would require the use of some other agent. Some preliminary experiments on a small scale relative to the protective treatment of animals against tuberculosis without the use of living tubercle bacilli have been made at the station, and this subject has been given considerable careful thought and study, but so far nothing of an encouraging nature can be reported.

The method of bovo-vaccination devised by Prof. J. F. Heymans, of Belgium, has been carefully tested with both cattle and hogs, and has been found to be wholly without value. This method, to judge from the claims made by Professor Heymans, has given excellent results in his own country, where it has been extensively used. These results may possibly be due to a careful supervision of the herds to which the treatment was applied by trained veterinarians. Such supervision would certainly, in the first place, lead to improved hygienic conditions and the removal of all advanced or clinical cases of tuberculosis from the treated herds, and clinical cases of tuberculosis are the most important source for the spread of tuberculosis among cattle, even though apparently healthy tuberculous cattle scatter tubercle bacilli quite freely.

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Investigations have been made to determine how much danger there is from the exposure of healthy to tuberculous hogs. These investigations are not yet complete, but as far as they have gone it is seemingly fair to conclude that contact of healthy with tuberculous hogs in a hog yard is not nearly the dangerous source of infection that the exposure of hogs to tuberculous cattle or to the feces of tuberculous cattle has been proven to be.

Some time ago the station proved that the commonest way for tuberculous cattle to expel tubercle bacilli is with their feces through their bowels. It was found that hogs exposed to the fresh manure of a herd of tuberculous cattle very rapidly became tuberculous. In this connection it seemed desirable to gain some information about the length of time that tubercle bacilli will remain alive and virulent in cattle feces, and especially in manure piles. Experiments made relative to this matter showed that tubercle bacilli die very rapidly on the exposed surface of manure, but that in the depth of a manure pile they may remain sufficiently virulent for months to cause tuberculosis in hogs that are exposed to the pile after a layer less than a foot thick has been removed from its surface. Hence, as in all the other work done by the station on the vitality and virulence of tubercle bacilli, the fact is here again illustrated that the bacterium of tuberculosis has an enormous amount of resistance to adverse conditions, provided it is not exposed to light or to a temperature which is high enough for the pasteurization of milk. This investigation is not yet fully completed, but we can now say with certainty that tubercle bacilli, capable of causing tuberculosis in hogs, may live more than three months in a manure pile from a stable of tuberculous cattle.

Some work done in connection with the pasteurization of milk, in which the milk was obtained from a cow affected with udder tuberculosis, showed that a temperature of 60° C. (140° F.), maintained for twenty minutes, invariably killed the tubercle bacilli. Over 100 guinea pigs injected with such pasteurized milk remained free from tuberculosis, while an equal number injected with unpasteurized milk from the same source contracted generalized tuberculosis with very few exceptions.

An experiment is still in progress relative to the elimination of tuberculosis from a herd of tuberculous cattle, and the derivation, in the most economical way, of a herd of sound cattle from one that is affected with this disease. It will be some time, however, before a report on this work can be written. At present we can say that congenital tuberculosis among calves is very rare unless they are produced by cows affected with very advanced tuberculosis, and that calves rarely contract tuberculosis during the first few weeks of their lives from exposure to their dams when the latter are not clinically affected and have sound udders. Milk from a tuberculous udder means the rapid and practically certain infection of all calves that drink it.

Among a number of tuberculous cattle kept for a long time at the station one observation is of considerable practical importance. It seems that when tuberculous cows are kept any length of time after the disease is somewhat advanced or has become clinically determinable, the development of udder tuberculosis and the extreme infection of the milk with tubercle bacilli is very common.

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During the year a fairly large number of samples of commercial butter were tested for tubercle bacilli. The tests, among other things, showed that commercial butter varies greatly as to the amount of water, curd, salt, fat, filth, bacteria, etc., which it contains. Six of the samples examined were found on microscopic examination to contain acid-fast bacteria that were indistinguishable, optically, from tubercle bacilli. Guinea-pig injections with samples of the butter caused tuberculosis in only one instance, but the injection tests were made with such very minute quantities that they can not be said to have given wholly reliable results. This investigation will be repeated and an effort made to distinguish between butter derived from raw and from pasteurized cream.

A number of samples of commercial tuberculin were tested to determine whether they were of sufficient potency for use as diagnostic agents for cattle tuberculosis. It is gratifying to say that all the samples tested were found to be satisfactory.

For the new year it is planned to make a careful test of the different methods of applying tuberculin to animals for diagnostic purposes, not with the idea that some other method will give better results than the subcutaneous injection which, when honestly and properly applied, has an accuracy that we can not reasonably hope to exceed, but mainly with the idea that some method for applying tuberculin may be found which will answer as a check against those frauds which are at times practiced by unscrupulous dealers in cattle to prevent a reaction from tuberculin even though tuberculosis is present.

An attempt has been made, by feeding guinea pigs with pasteurized milk from cows affected with udder tuberculosis, to determine whether the dead tubercle bacilli in such milk have an injurious effect on the body. This investigation has not yet given results of a sufficiently definite character to be reported. An effort will be made to study the possibly increased or reduced resistance to tuberculous infection which may be associated with the use of pasteurized infected milk.

OTHER WORK.

Hog diseases, Texas fever, cattle ticks, cattle-tick dips, blackleg, glanders, swamp fever, tetanus, cattle mange, infectious abortion, the internal and external parasites of sheep, rabies, and a number of other subjects have received more or less attention at the Experiment Station.

In addition to cooperative breeding investigations, the Experiment Station has provided the Animal Husbandry Division and other divisions of the Bureau with extensive facilities for independent investigations. As during former years, large numbers of small experiment animals and a large amount of forage were raised at the station, and a considerable quantity of material in the form of blackleg meat, normal and other sera, milk, etc., were supplied to the city laboratories of the Bureau.

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REPORT OF THE ACTING CHIEF OF THE BUREAU OF PLANT INDUSTRY.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
Washington, D. C., September 30, 1910.

SIR: I have the honor to submit herewith a report of the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1910.

Respectfully,

G. HAROLD POWELL,
Acting Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

GENERAL WORK OF THE YEAR.

The total funds appropriated by Congress for the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1910, were $1,709,266, of which $210,510 was for statutory salaries, $317,960 for the work in connection with the purchase and distribution of seeds, while the remainder, $1,180,796, was apportioned in definite items among the 32 branches of the Bureau conducting scientific or related work.

BUSINESS OPERATIONS.

The volume of correspondence of the Bureau during the past year entailed the preparation of replies to about 250,000 letters, covering a wide field of agricultural activity. This number is exclusive of many general inquiries received by the Bureau which can be answered through the sending of circular letters or publications. A large amount of correspondence has been handled by this means throughout the Bureau, a total of 78,826 copies of typewritten circulars having been prepared by a duplicating process in the central office of the Bureau during the past year.

In connection with the fiscal operations of the Bureau, 6,973 requisitions for supplies were issued; 14,300 accounts were received, audited, and paid; 190 requests for contracts and leases were made; 1,603 letters of authorization and amendments thereto were drawn; and 1,948 letters of instruction to field investigators were prepared.

From September 1, 1909, to August 31, 1910, the following changes in the personnel of the Bureau were made: Resignations, 166; deaths, 6; dismissal, 1; transfers from the Bureau, 26; and furloughs and

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terminations of appointments, 317; making a total of 516 employees dropped from the rolls during that period. There have been made in the same period 777 appointments, increasing the total force of the Bureau by 261. On September 1, 1910, the numerical strength of the Bureau was as follows: In Washington, 630; outside of Washington, 850; total, 1,480. The total number of employees in the Bureau on the same date a year ago was 1,219.

PUBLICATIONS.

The publications of the Bureau and its printing work have continued in charge of Mr. J. E. Rockwell, Editor, as heretofore.

An increased number of new publications was issued during the past fiscal year, the total aggregating 109, containing 2,654 pages, 159 plates, and 362 text figures. Of these publications 28 were bulletins or parts of bulletins in the special series of the Bureau, 26 were circulars of the numbered series of the Bureau, and 15 were Farmers' Bulletins. Twelve papers were contributed by the Bureau of Plant Industry to the Yearbook of the Department of Agriculture for 1909, all of which were reprinted in separate form for special distribution.

The publications of previous years which were reprinted during the past year numbered 62. The miscellaneous printing, binding, and ruling work required by the Bureau and handled in the office of the Editor involved the issuing of 1,150 requests upon the Division of Publications.

ORGANIZATION AND POLICY.

The year has been marked by several changes in the direction of various lines of work in the Bureau. On February 1, 1910, Mr. Albert F. Woods, Pathologist and Physiologist, and Assistant Chief of Bureau, resigned to become dean of the College of Agriculture of the University of Minnesota and director of the Minnesota Agricultural Experiment Station. Mr. Woods had been in the Department service for more than sixteen years, throughout that time being closely associated with Dr. B. T. Galloway, Chief of Bureau, in the development of the plant pathological and physiological work of the Department and in more recent years of the entire work of the Bureau of Plant Industry. Mr. G. Harold Powell, for several years Pomologist in Charge of the Fruit Transportation and Storage Investigations of the Bureau, was appointed Assistant Chief of Bureau to succeed Mr. Woods. Further changes in the Bureau organization and personnel are referred to elsewhere in this report.

Particular attention has been devoted during the year to a consideration of the project system of the Bureau, to effect necessary revision especially with reference to the interrelation of various lines of work. To this end a standing advisory committee on projects has been organized within the Bureau, whose duty it is to make recommendations to the Chief of Bureau with regard to the project work. An advisory committee on promotions of scientific employees, to serve for such employees the same purpose which the efficiency board of the Bureau now fulfills for the clerical staff, has also been organized. The work of these committees has been very effective in the general administration of the Bureau.

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LABORATORY OF PLANT PATHOLOGY.

The general laboratory and research work in plant pathology has continued under the immediate direction of Dr. Erwin F. Smith, Pathologist. Several lines of investigation which have been carried on in the laboratory for periods ranging from one to several years have been completed and the results prepared for publication in bulletin form.

BUD-ROT OF THE COCONUT PALM.—The study of the bud-rot of the coconut palm has been continued and its cause has been determined. Extensive experiments have been carried on with a view to its prevention and eradication. The results of several years' work are now in manuscript and will be submitted for publication at an early date.

DESTRUCTIVE TUMOR DISEASE OF LIMES AND OTHER CITRUS FRUITS.—A study has been made of a destructive tumor disease which has been shown to be of fungous origin and to attack not only limes, on which it was first observed, but also oranges, while artificial infections have been produced on the pomelo, lemon, and *Citrus trifoliata*. The fungus spreads far beyond the original point of infection, and this must be borne in mind in pruning for purposes of eradication, as mycelium has been traced in the stem from 1 to 2 feet beyond any external sign of infection. A bulletin containing the results of the investigation is ready for publication.

CROWN-GALL OF PLANTS.—The study of crown-gall has been continued in cooperation with Dr. C. O. Townsend, formerly of this Bureau, and Miss Nellie A. Brown, of the Office of Sugar-Plant Investigations. The crown-gall of cultivated plants has been shown to be cross-inoculable to an astonishing degree. Galls have been produced on various species belonging to widely different families by pure culture inoculations with *Bacterium tumefaciens* isolated from the Paris daisy. This organism has been inoculated many times successfully into the peach, rose, hop, sugar beet, white poplar, and other susceptible plants. That from the crown-gall of the peach has been many times inoculated into the Paris daisy, sugar beet, hop, and other plants. Successful cross-inoculations have also been obtained with the organisms isolated from the crown-galls of many other plants, among them apples infected with hairy-root, the cause of which has so long been a matter of conjecture and dispute. A bulletin containing a detailed account of these researches has been prepared for publication.

NEW SPOT DISEASE OF CAULIFLOWER.—Considerable attention has been given during the past year to a new disease of cauliflower. The cause has been determined, a biological study of the parasite has been made, and many experiments have been carried on to determine the conditions under which infection takes place. A bulletin concerning the disease is ready for publication.

COOPERATIVE STUDIES OF PLANT DISEASES.—In addition to the general laboratory work, studies are being made of the bacterial and fungous content of spoiled maize, biochemical studies of pure cultures having been undertaken by Dr. Carl L. Alsberg, of the Office of Drug-Plant Investigations. In cooperation with the Office of Sugar-Plant Investigations studies are being made of the interrelation of crown-

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gall organisms. A new and destructive disease of tomatoes in Michigan is also receiving attention, field treatments being under way by Mr. W. A. Orton, of this Bureau. Many bacterial diseases of plants are being studied as opportunity affords, and researches on banana diseases, especially a very destructive blight of the whole plant, have also been made.

PATHOLOGICAL COLLECTIONS AND INSPECTION WORK.

The collections of specimens of pathological material and the work connected therewith have continued in charge of Mrs. Flora W. Patterson, Mycologist. Numerous critical identifications have been made for experiment-station workers, collaborators, correspondents, and others interested in pathological work.

ADDITIONS TO THE COLLECTIONS.—The value of the collections has been increased by the addition of several new and rare sets of exsiccatæ during the past year. Among these is the collection of Guatemalan fungi made by the late Dr. W. A. Kellerman. The specimens of this set are only partly identified and will receive attention during the present year. Several new fungi on economic plants have been described and published during the year, and the laboratory work on the treatment of pineapple rot by formaldehyde gas has been completed. Certain new fungi found on material received through the Office of Seed and Plant Introduction have been studied and remedial measures promptly taken for their control. The pathological inspection of material so received has been continued.

USEFULNESS OF THE COLLECTIONS.—The bibliographical phase of the work in connection with the systematic insertion of specimens has been kept up to date and the indexes present a valuable means of assistance to all workers in mycological and pathological lines. It is proposed to verify certain data relating to valuable old sets or specimens in the herbarium by consultation of other large herbaria, thus greatly increasing the usefulness of the collections. Cooperative work on entomogenous fungi, cultural and systematic, is being extended, as its importance is increasing and the collections offer the best opportunity for such study. Attention is also being given to the identification of fungi from Guatemala, Hawaii, and Bermuda.

FRUIT-DISEASE INVESTIGATIONS.

The investigations of fruit diseases have been conducted, as in previous years, in charge of Mr. M. B. Waite, Pathologist, with the investigation of the diseases of grapes and small fruits in immediate charge of Dr. C. L. Shear and spraying demonstrations in charge of Mr. W. M. Scott.

CEDAR RUST OF THE APPLE.—There has been a notable outbreak in the season of 1910 of cedar rust or orange rust of the apple in the Eastern States. This disease has been increasing in severity for the last three years and has become serious in many sections of Virginia and over an area extending from middle Pennsylvania to eastern Tennessee, more particularly in the mountains and mountain valleys. This has occupied some of the attention of the investigators, particularly in the spraying experiments on the apple. For several years

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this office has urgently recommended the cutting down of the red cedars in the immediate vicinity of the commercial apple orchards, and after this year's experience many cedars are being cut down. On the other hand, the disease is apparently rather difficult to control by spraying, but has been proved at least partly preventable. Many striking examples have been observed this season in the increase of the disease where the cedars are abundant near the orchard.

PEAR-BLIGHT ERADICATION.—Pear-blight eradication work has been continued in California on about the same scale as last year. The disease appears to have been greatly reduced, especially in California and southern Oregon. This is due partly to the work of assistants in the field and partly to climatic conditions. The Rogue River valley, where Mr. P. J. O'Gara, Assistant Pathologist, has been working, has retained its fine pear orchards and stands as the best example of the effect of thorough work in controlling this disease by eradication. The results are due in large measure to the enthusiasm and thoroughness of the people in this valley and to the increased confidence in the methods recommended by the Department.

PECAN SCAB.—Work on pecan scab has been continued in South Carolina. The results of the first year's spraying experiment, while they showed that Bordeaux mixture could control the scab, did not result in entirely satisfactory crops, for a number of reasons. This work has been increased, new spraying experiments being under way at one additional point in South Carolina and at one point in Georgia. A series of fertilizer experiments on the pecan have been begun to determine the effect of fertilizers in controlling pecan diseases. The "drop" of pecans, by which the crop of nuts falls from the trees at various stages, is under observation and study, particularly in the fertilizer tests.

SPRAY INJURY TO APPLES.—The most striking thing that has taken place in apple spraying since the introduction of Bordeaux mixture for the control of apple diseases is the change from the copper to the sulphur compounds that has been brought about largely through the experiments of this office. The lime-sulphur solution is the leading one in use, though the self-boiled lime-sulphur and the iron sulphid are still under investigation. The spray russeting of the fruit by copper poisoning and the foliage injury due to the same cause had become so serious that considerable attention was devoted during the seasons of 1909 and 1910 to testing various spray mixtures. Exceptionally beautiful fruit, in most cases free from fungous spots and diseases, was obtained from the experimental plats. As a result, orchardists have taken up the spraying with sulphur compounds as a solution of this important difficulty.

Some injury has occurred where the mixture was used too strong or in cloudy weather. This was mostly on the tender foliage, and in hardly any case was it serious. The lime-sulphur solution, being the most convenient and satisfactory to use, has been accepted generally by orchardists for spraying apples. Where it has been combined with the arsenate of lead generally excellent results have been obtained with the combined spray; but in a few cases, undoubtedly owing to insufficient agitation, there has been some slight burning of the fruit,

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and, in still fewer instances, of the foliage. It is now known to be possible for the orchardists to make the lime-sulphur solution by boiling these materials on the farm, or it can be purchased on the market already prepared.

DEMONSTRATION SPRAYING.—The demonstrations in spraying for apple diseases have been continued, mainly in Virginia. This work has given excellent results and has been a great stimulus to the orchardists all over the country in the production of better fruit. It has encouraged the growing of larger crops of apples of finer quality, particularly in the eastern half of the United States, where fungous diseases are such a large factor in the output of the orchard. The crop of fruit this fall in the East will average better in quality than any crop of recent years because it has been sprayed more thoroughly and more scientifically.

PEACH BROWN-ROT.—The control of the brown-rot of the peach has been worked out during the past three years in a satisfactory manner through the utilization of the self-boiled lime-sulphur spray, as outlined in previous reports. The increased number of spraying demonstrations, particularly in cooperation with the Bureau of Entomology and with the combined self-boiled lime-sulphur and arsenate of lead have brought this matter still more prominently before the peach orchardists of the humid parts of the United States, where this disease plays such havoc in average seasons. Demonstrations carried out on a very large scale at several points in Georgia were extended to Virginia and West Virginia. The spraying of the peach, therefore, covers not only the brown-rot, but the black spot or peach scab and plum curculio, which makes the fruit wormy. The three great summer pests of this fruit, therefore, have been brought under control by spraying.

MISCELLANEOUS ORCHARD DISEASES.—Several miscellaneous orchard diseases have been investigated during the past season. The apple powdery mildew has been brought under control on the Pacific coast. Several fruit spots have been studied. Work on frost injuries to fruits has yielded some interesting points, and the protection of the blossoms from frosts by fires and smudges has been given attention, particularly by Mr. P. J. O'Gara, Assistant Pathologist, in the Rogue River valley. Additional studies have been made on the various types of frost injuries and methods of their prevention.

GRAPE DISEASES.—Work on grape diseases has been continued in New York, Pennsylvania, and New Jersey. Excellent results were obtained in the autumn of 1909. It is interesting to note that the Bordeaux mixture for use on the grape still retains its supremacy, though it has lost ground on the apple and most orchard fruits.

MISCELLANEOUS DISEASES OF SMALL FRUITS.—Work on the diseases of the cranberry has been carried out mainly in Massachusetts and New Jersey. In Massachusetts new work has been taken up in cooperation with the state experiment station. A number of other diseases of the small fruits have been studied in the field and numerous details in the life history of the fungi causing these diseases, including the anthracnoses, have been studied during the year.

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INVESTIGATIONS IN FOREST PATHOLOGY.

The work of the Bureau on forest diseases, which is conducted in close cooperation with the Forest Service, has continued in charge of Dr. Haven Metcalf, Pathologist. The diseases of ornamental and shade trees have also been studied in connection with the work.

BLISTER RUST OF WHITE PINE.—The work of Dr. Perley Spaulding, Pathologist, in controlling the imported blister rust of the white pine has been continued with very gratifying success. It is believed that the disease, although introduced into many localities, has thus far been prevented from obtaining a permanent foothold in the United States. Public opinion has become thoroughly aroused to the seriousness of the danger from this disease, and in consequence no importations by States and but few by private individuals are known to have been made this year. A National law prohibiting such irresponsible importation as may be still going on is very urgently needed. No other method of preventing further importation of the disease is practicable. Care has been taken to undertake no work on this disease which could be undertaken by the inspection authorities of the several States concerned. Despite this fact the funds available have proved insufficient for the work, and an appreciable part of the field expenses have been defrayed through a cooperative arrangement by the State of New York and a commercial paper company, in order that imperative work might be accomplished without dangerous delay. A fundamental bulletin on this disease is now in press.

BLIGHT OF CONIFEROUS SEEDLINGS.—The work of two seasons at Halsey, Nebr., on this disease by Doctor Spaulding and Mr. Carl P. Hartley, Assistant, shows conclusively that it is easily controllable by slight and perfectly practicable changes in management of water and shade in the nursery. This disease is one of the great factors determining success or failure in western forest-nursery practice and reforestation. The precise cause of the disease is still undetermined. A brief bulletin on this subject will soon be submitted for publication.

DAMPING-OFF OF EUCALYPTUS SEEDLINGS.—Work at the Lytle Creek nursery of the Forest Service in Lytle Creek canyon, California, by Dr. Perley Spaulding and Dr. A. H. Graves, Expert, shows that this disease, previously the cause of widespread loss in eucalyptus growing, is for all practicable purposes preventable by using the proper type of soil for planting. A circular on this subject will shortly be issued.

FUNDAMENTAL FACTS OF FOREST PATHOLOGY.—As the work of this office has progressed it has become increasingly evident that the researches in forest pathology made by European investigators are only very superficially applicable to American conditions. Accordingly it is necessary to conduct researches into the fundamental facts of the science. Such a piece of research is embodied in a bulletin prepared by Doctor Spaulding, entitled "The Timber Rot Caused by Lenzites Sepiaria," which discusses one of the most common causes of timber rot in America.

WORK IN THE NATIONAL FORESTS.—The work of the forest-disease survey, conducted by Dr. George G. Hedgcock, Pathologist, as well as statistics collected by the Forest Service, indicate that in America

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tree diseases and timber rot are second only to forest fires as causes of loss. The reduction of disease in the forest and of decay in cut timber must come about through gradual modifications and refinements of current forest practice and wood-preservation methods. To bring about such changes the closest possible cooperation between this Bureau and the Forest Service is necessary. Accordingly, one member of the staff of this office, Mr. C. J. Humphrey, Assistant, has been permanently stationed at the forest-products laboratory of the Forest Service at Madison, Wis., where he is working on the pathological data which underlie wood decay and wood preservation. Another member of the office staff, Dr. E. P. Meinicke, Expert, is permanently stationed in California to work on the pathological problems arising in district 5 of the Forest Service. It is hoped that by the next fiscal year three more men may be employed, to be stationed in three other forest districts to work out the local pathological problems arising in the administration of those Forests and to apply in local practice the results obtained in the central office.

Work with ornamental and shade trees.—The increasing public interest in the culture of shade and ornamental trees and the great individual value of such trees make it desirable that a larger share of the effort of this office be devoted to this class of work. As far as possible work of this character is being undertaken. Experiments are already under way to determine the real value of tree surgery and to control certain specific diseases. Cost of treatment is almost a negligible factor in ornamental tree work; hence this is a particularly rich field of investigation.

COTTON AND TRUCK-CROP DISEASES AND SUGAR-PLANT INVESTIGATIONS.

The investigations of diseases of cotton and truck crops and the plant-disease survey have continued in charge of Mr. W. A. Orton, Pathologist. On January 16, 1910, the sugar-plant investigations, upon the resignation of Dr. C. O. Townsend, Pathologist in Charge, were placed under the charge of Mr. Orton. A brief summary of the progress made in these lines of work follows. Assisting in the investigations during all or a part of the year have been Messrs. H. A. Edson and J. B. Norton, Physiologists; L. L. Harter, Assistant Physiologist; W. W. Gilbert and H. B. Shaw, Assistant Pathologists; and E. C. Rittue and Misses Nellie A. Brown, Ethel C. Field, and Clara O. Jamieson, Assistants.

Cotton diseases.—The dissemination of wilt-resistant Upland cottons has been continued, and progress has been made in developing new strains combining wilt resistance with adaptation to boll-weevil conditions. As the weevil advances, the need for such varieties will become increasingly urgent.

Potato diseases.—The Fusarium wilt of the potato has been found to be widely prevalent. It threatens to become one of the worst potato diseases. The results so far achieved indicate that rotation of crops and rejection of infected seed will go far toward preventing losses. A method of testing the resistance of potatoes to the late-blight fungus has been found, which promises to facilitate very greatly the breeding of resistant varieties. Potato blackleg, a disease

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of recent introduction, has greatly increased during the past two years and will require study to perfect means of control. A new disease, potato wart, is spreading in Europe, and there is great danger of its introduction into this country.

MISCELLANEOUS DISEASES OF TRUCK CROPS.—The new and dangerous Michigan bacterial blight of tomatoes, now being studied in the laboratory by Dr. Erwin F. Smith, is the subject of experiments for control in the field. Malnutrition problems are being continued along the lines outlined in previous reports, and various other diseases of truck crops are being studied.

BREEDING RUST-RESISTANT ASPARAGUS.—The work of breeding an asparagus resistant to rust has progressed favorably. Several thousand pedigreed seedlings from resistant parents are now growing at Concord, Mass. The most progressive farmers in that region are undertaking breeding work on their own farms, following the methods outlined by this Bureau.

SUGAR-BEET DISEASES.—Studies upon diseases of the beet have progressed favorably. The Cercospora leaf-spot has prevailed to a serious extent in the Arkansas Valley of Colorado and Kansas. The Department has been able to control this disease in Michigan and is now extending its experiments to the West. Studies of the curly-top of the beet are being continued in the West to learn more of the nature of the disease, and, in cooperation with the Bureau of Entomology, to develop methods of controlling the leaf-hopper which causes it. Several other beet diseases are receiving attention.

SUGAR-BEET IMPROVEMENT.—The breeding of beets for increased sugar yield, for the production of American seed, for the development of single-germ seed, for the production of alkali-resistant and early and late maturing strains, and to develop other desirable characters are lines of work that have been continued during the past year. They are essential to the success of the American sugar-beet industry and must be carried out on a large scale, as they require a more extensive equipment than most breeding problems.

SUGAR-BEET CULTURE.—A beginning has been made in the study of beet nutrition, but many problems regarding methods of planting, thinning, culture, and the technique of beet growing are yet to be solved. The working out of these problems will contribute largely toward the lessening of the cost of beet production and will lead to a great increase in the acreage grown. The most desirable rotations of crops and the best methods of improving the soil for beets are being studied. Fundamental investigations upon a comprehensive scale along these lines are essential. The fullest cooperation is tendered the Department by the various beet factories and there is a great demand for an extension of the work.

SOIL BACTERIOLOGY AND WATER-PURIFICATION INVESTIGATIONS.

The investigations of the Bureau bearing upon general soil bacteriology, the use of nitrogen-fixing bacteria for inoculating leguminous crops, and the improvement of farm water supplies have continued

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in charge of Mr. Karl F. Kellerman, Physiologist. The water-purification work has consisted chiefly of advisory correspondence, though in some places personal supervision of improvements has been undertaken.

WORK WITH NODULE-FORMING BACTERIA.—Pure cultures of nodule-forming bacteria for inoculating legumes have been distributed during the year and additional data have been gathered concerning the limitations of successful inoculation. Especially with alfalfa in the Eastern States, it has been found that successful inoculation is correlated very closely with the reaction of the soil to neutral litmus paper. The inoculation of crimson clover seems to show no correlation with the litmus reaction, while the inoculation of vetch is about halfway between these extremes. More detailed field work in connection with the experimental distribution of pure cultures for inoculating legumes will be undertaken during the coming year.

STUDIES IN SOIL BACTERIOLOGY.—Extensive studies regarding the correlation between nitrification and crop production have been made in different parts of the United States. It has been found that in certain soils of the Coastal Plain which have a high magnesium content the application of a pure calcium lime, such as oyster-shell lime, is very much more beneficial to the action of nitrifying bacteria than is the application of lime containing a high percentage of magnesium. Investigations carried on chiefly in Utah, Nevada, and Virginia show a very close relationship between the crop-producing power of a soil and the development of nitrifying bacteria in that soil. These investigations will be extended to cover more types of soil organisms, and, where possible, field work in cooperation with other offices of the Bureau will be undertaken. It is also planned to make a general survey of the bacterial conditions obtaining throughout various parts of the United States.

CROP PHYSIOLOGY AND BREEDING INVESTIGATIONS.

Investigations concerned primarily with the determination of the factors underlying the physiology of crop production have been continued under the immediate supervision of Mr. Walter T. Swingle, Physiologist, assisted by Prof. S. C. Mason, Arboriculturist in Charge of Dry-Land Arboricultural Investigations.

BREEDING HARDY TYPES OF CITRUS FRUITS.—The hardy hybrids obtained by crossing the common orange with the trifoliate orange of Japan and China have yielded a considerable number of new citrus varieties suitable for culture throughout the Cotton States. Some thousands of grafted plants of half a dozen of the best varieties of these citranges, as they are called, have been distributed in the cotton regions and many favorable reports have been obtained from the growers. The work has been extended during the past two years, more than 10,000 crosses having been made in the spring of 1909 by Mr. Swingle in Florida and by Mr. E. M. Savage, Assistant, in California. Many of these are complex hybrids—that is, the citranges, themselves of hybrid origin, have been crossed with various other citrus fruits in the hope of obtaining hybrid forms which contain only a small proportion of the blood of trifoliata and which could be rea-

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sonably expected to be somewhat hardier than the existing oranges and grape fruits while being scarcely, if at all, inferior in flavor. Other hybrids have been made between citranges on the one hand and the trifoliate parent on the other, the object being to originate hardy deciduous citrus fruits which can be grown beyond the northern limit of cotton culture. Such hybrids would undoubtedly yield very acid fruits of inferior quality which might, nevertheless, be useful for home culture, where the fruits could be utilized in making ades and for culinary purposes.

In cooperation with the Office of Foreign Seed and Plant Introduction, an effort is being made to obtain new types of citrus fruits and of wild species allied to the citrus fruits for use in breeding new types and new stocks upon which to graft them. Some of these new importations are promising for use in the breeding of hardy citrus fruits. Others promise to be of value for use as stocks, permitting the extension of citrus culture to soil not well adapted to the stocks now in use.

FIG INVESTIGATIONS AND BREEDING.—Smyrna-fig culture has been established in California largely as a result of the introduction of the fig insect by the Department of Agriculture in the spring of 1899. Smyrna-fig trees will not bear a crop of fruit unless the flowers are pollinated by the minute insect which lives in the male fig, the so-called caprifig. It has been found necessary to give much attention to the introduction of proper varieties of caprifigs suitable for use in different localities in the fig-growing States of the Southwest. Cuttings and rooted plants of good varieties of caprifigs and new varieties of Smyrna figs are being distributed to cooperators on condition that they will plant seedlings of the best type of Smyrna figs and grow them to fruiting. In this way it is hoped to originate new strains of Smyrna figs and new varieties of caprifigs adapted to the local climatic and soil conditions.

Several promising new varieties of figs have already been discovered in the seedling fig orchard at Loomis, Cal., now under lease to the Department of Agriculture. One of these varieties, which has been named the Rixford, is a so-called self-sealing fig. As the fruit ripens, a small drop of gum appears in the mouth of the fig; this gum hardens and completely closes the fruit, preventing the access of insects and at the same time enabling the fig to withstand rainstorms without injury. This type of fig is likely to prove important in attempting to extend fig culture in the foothill regions of California, where it is probable that the best grade of fruit can be produced. In such regions rains often occur early in autumn before the crop is ripe, and ordinary varieties having a large, open eye are likely to be injured. A self-sealing variety would be able to withstand such storms without injury. Cuttings of this and other self-sealing varieties have been widely distributed to cooperators in California and other Southwestern States.

ESTABLISHMENT OF DATE CULTURE.—In cooperation with the Office of Foreign Seed and Plant Introduction a large number of different varieties of the date palm have been imported from Algeria, Tunis, Egypt, Arabia, Mesopotamia, Persia, and Beluchistan. These are

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now growing in the five cooperative date gardens of the Department of Agriculture in Texas, Arizona, and California. A scientific study of the climatic, soil, and cultural requirements of the different date varieties is important in the establishment of this new industry, for the reason that the date palm, unlike all ordinary fruit crops, is produced by plants which can not be budded or grafted. If an orchard is set to an inferior variety it is a total loss, since the trees must be grubbed up and new ones planted. A date orchard is one of the most expensive to plant and bring to bearing, because the offshoots must be imported from the deserts of the Old World at a net cost to the grower of $3 to $6 each. It is important, therefore, to be able to recommend to the growers varieties which are adapted to their local conditions. Every effort has been made to discourage the premature exploitation of date culture and to test thoroughly at stations under the control of the Federal and State governments all obtainable varieties.

In order to familiarize growers with the handling of date palms and in the hope of originating new varieties particularly well adapted to local conditions, large quantities of seeds of the best varieties have been distributed to cooperators in the date-garden regions of California, Arizona, and Texas. The cooperators receive the seed free of cost and upon planting out the seedlings in orchard form receive from the cooperative date gardens under the control of this Department a quota of offshoots of imported varieties as a bonus for such planting. In this way the date growers become accustomed to the proper methods of planting and cultivating imported date offshoots and learn how to pollinate and harvest the crop.

Cooperative work on the Indian reservations.—In cooperation with the Office of Indian Affairs of the Department of the Interior, investigations are being conducted on several of the Indian reservations in the Southwest looking toward the establishment of new agricultural industries particularly adapted to the local soil, climatic, and labor conditions. The Office of Crop Physiology and Breeding utilizes these cooperative testing and demonstration gardens in the study of the climatic, soil, and cultural requirements of different varieties of crop plants and in the breeding of new sorts better adapted to the local conditions. Indian labor is utilized in the carrying out of these experiments, thus familiarizing the Indians with the growing of new crops. These investigations are likely to prove of value, not only to the Indians, but to the white settlers in lands adjoining the reservations. This particularly applies to Egyptian cotton, which has been grown at Sacaton, Ariz., on a considerable scale during the past two years in cooperation with other offices of the Bureau. The crops raised on the testing and demonstration farm during the years 1908 and 1909 were recently sold by the Office of Indian Affairs at the unusual price of 31 cents a pound. Egyptian-cotton culture on a small scale is likely to be profitable for the Indians themselves, and the Indian boys and women are at the same time acquiring a training in the picking and handling of the crop which can be turned to good account should the growing of Egyptian cotton be undertaken on any considerable scale in Arizona and California.

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ACCLIMATIZATION AND ADAPTATION OF COTTON, CORN, AND OTHER CROPS.

The investigations directed toward the acclimatization and adaptation of varieties of cotton, corn, and other crop plants that have originated in tropical countries have been continued under the general supervision of Mr. O. F. Cook, Bionomist, assisted by Mr. G. N. Collins, Botanist. Different branches of the field investigations are conducted by Messrs. S. M. Bain, E. B. Boykin, J. H. Kinsler, F. L. Lewton, A. McLachlan, H. Pittier, and D. A. Saunders. Particular attention is being given to the adaptive characters, environmental reactions, and methods of breeding and local adjustment of varieties of cultivated plants, in order to determine the best methods (1) of improving the crops, (2) of developing increased resistance to unfavorable conditions, diseases, and insect enemies, and (3) of extending the range of cultivation in the United States.

INCREASED YIELDS FROM CROSSING VARIETIES OF CORN.—Further tests in crossing varieties indicate a very wide application of this method of increasing the yields of corn. The results of experiments with more than twenty different crosses grown in seven States have been brought together. In nearly all crosses the yields were materially increased over the average of the parent varieties, the increase ranging as high as 50 per cent. These experiments have shown further that the crossed strains possess in a very marked degree the ability to withstand drought, a fact of obvious importance in the extension of corn culture in the United States. A large series of crosses have been made between the different types and varieties of corn to determine which combinations are the most advantageous for different conditions of climate and soil.

ADAPTIVE CHARACTERS IN CORN.—Experiments in southern Texas have demonstrated the importance of growing only varieties of corn that have the ears well protected by long, tightly closed husks. The lack of this character is one of the chief reasons why carefully selected northern varieties are usually a disappointment in this section. Hybrids with the small Chinese type of corn have proved to be prolific and specially adapted to withstand high winds, and have also shown a decided increase in drought resistance, though the silks are not as well protected by the bases of the leaves as in the Chinese parent variety.

ACCLIMATIZATION OF WEEVIL-RESISTING TYPES OF COTTON.—Experiments have been continued with Central American types of Upland cotton introduced because of their weevil-resisting characters. The most effective weevil-resistant character of the Kekchi cotton in the dry climate of southern Texas is the tendency to produce longer branches and more numerous bolls close to the ground. Select strains with large bolls and good fiber have been developed and have shown themselves more productive than any of our United States Upland varieties in several experiments. Field tests are to be made as soon as sufficient seed can be grown.

CHARACTERS CHANGED DURING ACCLIMATIZATION.—In addition to the excessive growth and abnormal sterility of cottons newly introduced from Central America, other very definite changes of characters take

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place. The bolls are much smaller, the average number of locks is greatly reduced, and the lint becomes short and sparse. Advance of acclimatization brings a return to the normal characters of the type. Along with the increase of fertility the bolls become large, the locks more numerous, and the lint longer and more abundant. Some investigators have denied the reality of such changes, but in the case of cotton they are capable of very definite demonstration.

MEXICAN BIG-BOLL COTTONS.—Experiments in the acclimatization of new types of cotton from southern Mexico continue to promise favorable results. Even under extreme conditions of drought these new types have produced longer lint and larger bolls than any of the Texas big-boll varieties grown under the same conditions.

ADAPTATION OF TEXAS COTTONS TO THE SOUTHEASTERN STATES.—Many experiments in Texas have shown that the more extreme climatic conditions interfere with the normal behavior of eastern varieties, none of these proving equal to the Texas big-boll varieties. Recent experiments in South Carolina indicate that the Texas cottons are superior to many of the eastern varieties, and seem likely to attain general popularity. The very large bolls render them attractive to the farmer and their storm-proof qualities are especially valuable under eastern conditions, where extensive damage is often wrought by the wetting of the fiber in the field. The denser fiber of the Texas cottons has been found to resist wetting, and these cottons may receive little injury from storms that are very destructive to eastern varieties of cotton.

IMPROVED VARIETIES OF TEXAS BIG-BOLL COTTONS.—Recognition of the superiority of the Texas big-boll cottons over all other short-staple varieties has led to a greater concentration of breeding work in this direction. A series of new big-boll selections have been bred and tested in central and northern Texas for several years by Dr. D. A. Saunders, Special Agent. Some of the best strains have now reached the stage of commercial production, and one of them has been included in the Congressional seed distribution for the present year under the name "Lone Star." In several tests in the vicinity of Waco, Tex., it has excelled the big-boll varieties now in cultivation, not only in the size of the bolls but in earliness, yield, and length of fiber.

EXTREME EARLINESS OF HOPI COTTON.—History does not show that cotton was cultivated by any of the native tribes that occupied the region of the present cotton belt, but the Hopi and other southwestern Indians had a native cotton culture. Experiments have been made with the Hopi cotton in Texas for several years by Mr. F. L. Lewton, Assistant Botanist, and it has been found to excel all other Upland types in earliness and drought resistance, characters that are often of great importance in avoiding the ravages of the boll weevil. Variations in the direction of large bolls and abundant lint have been found in the Hopi cotton, and selections are being made to test the possibility of originating very early drought-resistant varieties from this native southwestern type of Upland cotton.

LOCAL ADJUSTMENT OF COTTON VARIETIES.—The importance of adaptation of varieties to local conditions is being more carefully determined by test plantings of the same stocks of seed of tne same

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series of varieties in different parts of the cotton belt. It has long been recognized that varieties are adapted to particular conditions of growth and may not show normal behavior when placed under new or unfavorable conditions, but no adequate effort has been made to determine the nature and extent of these supposed limitations of varieties to particular conditions and the possibility of avoiding such limitations by continued selection for local adjustment.

STATUS OF THE UPLAND LONG-STAPLE INDUSTRY.—The spread of the boll weevil and the extremely unfavorable climatic conditions of the season of 1909 resulted in a serious decline in the Upland long-staple industry of Mississippi and Louisiana. The future of this industry has become a matter of much solicitude, not only to the producers of the long-staple cotton, but to the manufacturers of fine fabrics, who require the superior fiber. Larger quantities of cotton are being imported from Egypt, but the simultaneous decline of production in that country is causing very high prices. Special measures are needed, therefore, to maintain this branch of the cotton industry and to extend it into other districts. Though other parts of the cotton belt may not be able to produce a fiber equal to that of the "Delta" long-staple region, other grades are likely to find a much better market than in former years.

UTILIZATION OF THE COLUMBIA COTTON.—The Columbia variety, originated by the Department of Agriculture several years ago, is gradually gaining in popularity and is now being adopted as an early type in long-staple districts where the later and less prolific varieties are being excluded by the boll weevils. It has seemed advisable to continue the breeding and distribution of the Columbia cotton, so that it might be fully tested in all districts adapted to long-staple production.

EARLY LONG-STAPLE VARIETIES.—Series of long-staple varieties other than the Columbia cotton developed in South Carolina have been bred in Texas and Louisiana with the special purpose of developing the utmost degree of earliness that can be combined with the production of a long fiber. It was foreseen that the lateness of the old long-staple varieties would render them especially liable to injury from the boll weevil, and that early short-staple varieties would be likely to drive out the long-staple varieties, a change that has gone on very rapidly in the last few years. The possibility of restoring and maintaining the production of long-staple cotton in the presence of the boll weevil now seems to depend upon the introduction of early long-staple varieties like those that are now being bred and tested.

LONG-STAPLE COTTON FOR THE RIO GRANDE VALLEY.—Experiments with one of the new types of Mexican cotton in the Rio Grande Valley indicate a possibility of producing long-staple cotton in this region. The Mexican cotton has shown itself much more productive and of a more uniform fiber than the United States varieties of long-staple cotton grown under the same conditions. Seasonal vicissitudes are a serious difficulty, but many localities are being provided with irrigation facilities that may prevent the loss of the crop in dry seasons and maintain the quality of the fiber. Limited supplies of irrigation water could probably be used to better advantage with cotton than with any other crop.

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EGYPTIAN COTTON CULTURE.—During the past year observations have been made on the methods of cotton culture employed in Egypt. The contamination of the Egyptian cotton with an inferior type called Hindi involves extra labor and expense to sort out the inferior fiber before ginning. Inspection of a large number of cotton fields in Egypt shows that the Hindi contamination is large and very generally distributed. The Egyptian crop as a whole is much more diverse than the improved strains of Egyptian cotton that have been developed by the Bureau of Plant Industry in Arizona. The uniformity of the Arizona Egyptian cotton may be expected to give it a place in the market without the need of sorting the fiber.

Comparison of the methods of cotton culture used in Egypt shows a wide divergence from those employed in the United States. Abundance of cheap labor enables hand work to be used exclusively in the cultivation and irrigation of the crop. Closer planting makes possible the growing of larger numbers of plants and at the same time induces earlier fruiting. The plants produce fewer vegetative branches and the harvest is more easily gathered. Though the Egyptian system as a whole is not to be imitated under our conditions, its advantages are to be given careful consideration in developing new methods of cultivation for this crop.

VALUE OF FIRST-GENERATION COTTON HYBRIDS.—Further experiments with first-generation hybrids between Upland and Egyptian cottons indicate that such hybrids have a much wider range of adaptation to external conditions than the parent stocks, in addition to their ability to produce a larger crop of superior fiber. In the season of 1910 first-generation hybrids have shown their ability to continue to grow and to produce flowers and fruit under circumstances that seriously interfered with the development of the parent sorts planted in adjacent rows. This greater hardiness increases the prospect of utilizing first-generation cotton hybrids for commercial production, if means can be discovered for producing sufficient quantities of hybrid seed. The good qualities of the first-generation hybrids are not preserved in later generations. The practical value of such hybrids seems to be limited to the possibility of utilizing the superior first generation.

CROSS-FERTILIZATION IN PRIMITIVE TYPES OF WHEAT.—The habits of a recently discovered wild type of wheat have been studied in Palestine and compared with those of domesticated wheat and of wheat escaped from cultivation. Adaptations for cross-fertilization were found in the wild wheat and indications of the same habit in primitive stocks of the domesticated species grown in the same district. The anthers of some flowers are exserted before the shedding of the pollen, and, conversely, in some flowers the glumes spread apart so that pollen is admitted before the anthers mature. These facts indicate that the habit of strict self-fertilization found among our cultivated varieties of wheat does not represent an original ancestral condition. Analogies with other plants suggest that eventual decline in vigor, fertility, and disease resistance may be expected in varieties that are limited to self-fertilization. No indications of rust or other diseases were found among the cross-fertilized wild wheat.

ACCLIMATIZATION OF DIVERSE TYPES OF WHEAT.—A very wide range of diversity is shown in some of the primitive types of wheat cultivated in arid subtropical districts in Palestine. The native wheat fields produce excellent crops, but the individual plants show a wide

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range of differences, such as bearded or beardless heads, very open or closely crowded spikelets, white, red, or black chaff, with smooth, pruinose, or velvety surfaces, dark or light grains, etc. The occurrence of this primitive diversity under conditions that admit of normal cross-fertilization indicates that the same method of acclimatization can be applied to wheat as to diverse types of cotton or other cross-fertilized crop plants. The full range of adaptation of a widely diversified type can be obtained instead of the limited possibilities of a self-fertilized strain that may have been selected because of its adaptation to entirely different conditions. The possibility of acclimatizing new types of wheat adapted to arid subtropical districts of the Southwestern States becomes worthy of careful investigation.

ACCLIMATIZATION OF TROPICAL CROPS AND ORNAMENTAL TREES.—Conditions are now favorable for a thorough test of the possibilities of acclimatizing tropical crop plants, rubber-producing trees, and ornamentals in the warmer districts of Texas, Arizona, and California. The numerous towns and villages recently established afford sheltered situations, and the people are anxious to undertake experimental plantings and give them the necessary care. The protection of an irrigating canal or a warm spring sometimes proves sufficient to permit the growing of avocados or other tropical trees, even in localities otherwise subject to severe frosts.

CULTURAL POSSIBILITIES OF THE COCONUT PALM.—A study of the botany, history, and biology of the coconut palm shows that this most useful tree is not limited to tropical maritime conditions. Though generally cultivated on seacoasts, it is able to thrive in interior localities with sufficient heat and sunlight. Hardier varieties that may prove capable of acclimatization in the United States are to be sought in the original home of the species in the interior of South America. Experiments should not be confined to the coast of southern Florida, but extended to frost-free interior localities in the Southwestern States.

DRUG-PLANT, POISONOUS-PLANT, AND GENERAL PHYSIOLOGICAL INVESTIGATIONS.

The work of the Bureau on drug plants, poisonous plants, and other special physiological problems has been continued along the lines described in previous reports, under the immediate charge of Dr. Rodney H. True, Physiologist.

WORK ON DRUG PLANTS AND OTHER SPECIAL CROPS.

The field work, largely carried on at the several testing gardens, has covered a large number of sorts of plants, both imported and native. Through the effective cooperation of the Office of Foreign Seed and Plant Introduction, plants from various parts of the world have been received and placed for trial in such of the testing gardens as promise to yield the best results.

DRUG-PLANT TESTING GARDENS.—The garden located on the experimental farm at Arlington, Va., under the care of Dr. G. F. Klugh, Scientific Assistant, continued to receive a large part of the plants

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under study. The climate of this vicinity seems to be adapted to a wider range of species than that of any of our other gardens. A hop garden has been begun in which it is hoped to collect for detailed comparison as many as possible of the commercial hop sorts. The application of the principles of plant improvement to the most important medicinal plants under trial promises to yield far-reaching results.

The testing garden in South Carolina carries a relatively small number of kinds of plants, attention having been given rather to testing on a larger scale the commercial possibilities of some of the more promising things. Paprika pepper of the Hungarian style has been grown by Mr. T. B. Young, Scientific Assistant, in cooperation with a number of farmers. A favorable yield was obtained this year, aggregating about 45,000 pounds of dried peppers, which were disposed of to spice millers at a fair price. This crop seems likely not to need much further attention from the Department. The more pungent sorts used in making cayenne, for which a wider market exists, need a similar study in the hope that this much larger market may be supplied as a result of home industry.

CAMPHOR AND OTHER INVESTIGATIONS IN FLORIDA.—At the Florida testing garden a considerable number of plants are being tested, among others ginger, turmeric, oil-bearing grasses, and other fragrant plants. Lemon grass seems to promise good results, as far as thriftiness and oil content are concerned, but seems to suffer somewhat from frost. Several native mints when cultivated thrive very well and deserve careful consideration. The future of the volatile-oil experiments seems to be very promising.

In the investigation of camphor, the progress of an experiment which depends on the growing of trees is of necessity not very rapid. The seedlings grown from trees of high camphor content have in large part been transferred to the nursery in the open, and planting to the field will soon be begun by Mr. S. C. Hood, Scientific Assistant, in charge of the experiment. The equipment of the experimental factory is also receiving attention, a new form of condenser being among the features of greatest interest. Rather severe frosts have been experienced during the year, but apart from some temporary injury to the tops no harm was done.

NEW TESTING GARDEN IN WISCONSIN.—Arrangements have been made with the University of Wisconsin whereby a drug-plant testing garden has been established at Madison. This is the only garden located in the colder part of the country and it will supply conditions for the testing of plants demanding rigorous conditions. About thirty sorts of drug and related plants were grown and observed during the year. It seems probable that many of the most important drug plants, belladonna, for instance, will not survive the winter under commercial conditions, but others are more promising.

PERFUMERY-PLANT INVESTIGATIONS.—Field and laboratory work on native and imported plants yielding volatile oils used in perfumery making, the scenting of soaps, etc., has been continued by Mr. Frank Rabak, Chemical Biologist, in cooperation with the testing gardens in Florida and at Arlington, Va. Some weeds and other wild plants have received attention. The work in Florida with lemon grass and

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rose geranium has been somewhat interfered with by frosts, and a possible deterrent factor has been developed, but it is believed that we can work out ways of meeting these conditions except at times of unusual severity. Among the weeds yielding interesting products may be mentioned the ordinary fireweed, *Leptilon canadense* (*Erigeron canadensis*). This plant occurs in large quantities over a wide area and contains an oil yielding a number of products valuable in the arts.

HOP INVESTIGATIONS.—The hop-improvement work has been continued by Dr. W. W. Stockberger, Physiologist, with very interesting results. Seedlings marked by great vigor and other desirable qualities seem to have been obtained. The answer to the important question of yield has not yet had time to develop. An intensive study of a representative acre of hops with reference to sources of loss has shown that practical parts of field handling are often neglected. The number of vines trained is apparently a more important factor than has been recognized. Further studies on field methods promise important results. In cooperation with Mr. Rabak, Doctor Stockberger has been investigating the relation of certain hop constituents to the quality and price of the products. The volatile oils have given very interesting results. A study of the resins promises to be even more significant.

TEA-CULTURE INVESTIGATIONS.—The tea work at Summerville, S. C., in cooperation with Dr. Charles U. Shepard, has been continued with good results. A very satisfactory crop of tea was grown, harvested, and promptly sold. The demand for American tea, especially in the South, has increased to a great degree, and the question of a sale seems to have been decidedly relieved. The efforts of Mr. G. F. Mitchell, Scientific Assistant, to devise a practical pruner seem at last to have been rewarded. Tea can now be pruned by machinery much more rapidly and economically than heretofore, and summer pruning, not always possible with hand labor, can now be resorted to with greater freedom, with a resulting increase of yield. A closer system of picking has been followed during the past year, with the result that a tea of very high quality has been obtained, at the cost, to a certain extent, of quantity.

POISONOUS-PLANT INVESTIGATIONS.

The field and laboratory work on poisonous plants has been continued along the same general lines as heretofore, and has made good progress.

LOCO-WEED INVESTIGATIONS.—A study of the relation of the loco-weed disease to the presence of barium in the weeds has been continued by Dr. C. D. Marsh, Physiologist, and his assistants, with the conclusion that no connection can be shown to exist. The symptoms of barium poisoning appear not to agree with those of the loco-weed disease. A laboratory study of the constituents of the loco weeds, by Dr. C. L. Alsberg and Mr. O. F. Black, Chemical Biologists, has been carried out with results which support the conclusion that barium is not responsible for the trouble caused by these plants. A publication covering these investigations is in an advanced state of preparation.

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LARKSPUR POISONING.—Work on this important source of loss in the West has been continued at Baldwin, Colo. The main characteristics of the action of the various sorts of larkspur have been fairly well developed and remedial measures have been sought with an encouraging degree of success.

COOPERATION WITH THE FOREST SERVICE.—The important line of work in cooperation with the Forest Service has been continued. An additional number of forests have been visited and the probable cause of trouble on account of poisonous plants in many places has been ascertained. In consultation with Forest Service officers, means of reducing the chances of loss have in some places been put into operation.

RELATION OF CORN TO PELLAGRA.—An investigation of the relation between the spoiling of corn and the occurrence of the disease known as pellagra has been undertaken by Dr. C. L. Alsberg and Mr. O. F. Black. The connection of spoiled corn with this disease has often been asserted or denied. Since this question affects one of our staple agricultural products, which is likewise an important item of commerce, this problem becomes one of great importance. As the constituents of unspoiled corn seem never to have been adequately studied, the investigation has of necessity taken a rather wide range. A paper of a somewhat popular character has been prepared concerning spoiled corn and the methods of detecting deterioration.

MISCELLANEOUS LABORATORY WORK.—Many inquiries have been received concerning the possible poisonous properties of the "wonderberry" and related solanaceous berries, which have been the subject of considerable public interest, and preliminary investigations on this subject have been undertaken.

The products developed in culture media by bacteria parasitic on plants have been investigated in cooperation with Dr. Erwin F. Smith, Pathologist in Charge of the Laboratory of Plant Pathology, a brief paper on the production of gluconic acid by the olive tubercle organism having been prepared.

It not infrequently happens that crude drugs of native origin, collected by untrained people, become confused, and a careful study of the plants concerned is required in order to ascertain the real condition of affairs. The crude drug "yam root," or "Dioscorea," having come into this confused condition, a study of the whole group of the Dioscoreæ of this country has been made by Mr. H. H. Bartlett, Chemical Biologist, and the difficulty solved. A bulletin presenting the results has been prepared.

GENERAL PHYSIOLOGICAL INVESTIGATIONS.

Various problems of a general physiological nature, bearing upon the handling and keeping of different crops, have continued to receive attention and good progress has been made along several lines.

PHYSIOLOGICAL STUDIES ON TRUCK AND OTHER CROPS.—The difficulty of successfully storing sweet potatoes, onions, and certain other vegetables has led to an investigation by Dr. H. Hasselbring, Physiologist, of the physiological conditions involved in such storage and in the decay which so often leads to heavy losses. Work on the sweet

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potato in cooperation with Prof. L. C. Corbett, Horticulturist, has been begun.

The occurrence of serious pathological conditions in spinach and cabbage in the vicinity of Norfolk, Va., has led to a study, in cooperation with the Office of Truck-Crop Diseases and Sugar-Plant Investigations, of the physiological behavior of the plants concerned in relation to their nutrition. This work, now in progress, is conducted by Doctors Hasselbring and Alsberg. In cooperation with the same office a physiological study of the relation of light intensity to sugar production in the beet has been undertaken.

A physiological laboratory study of the significance of a series of chemical substances in plant growth has been undertaken in the hope of throwing some light on important phases of plant requirements. This rather technical investigation is carried on by the Physiologist in Charge, assisted by Mr. H. H. Bartlett, Chemical Biologist.

LEMON INVESTIGATIONS.—The "sweating" process resorted to in order to color lemons rapidly has been made the subject of a special study. Experience has shown that methods supposed to improve on the old oil-stove device do not serve the purpose. Mr. A. F. Sievers, Chemical Biologist, has shown that heat and humidity are not as important factors in bringing about the desired change as has been supposed, the work being done rather by some of the gaseous products of incomplete combustion, generated by the oil stoves. This conclusion, if applicable as is now supposed, should have an important bearing on sweat-room construction and operation, quickening the time of coloring, reducing expense for fuel, and diminishing fire risks.

PLANS FOR FUTURE WORK.

The same general outline of work will be continued during the ensuing year, in order to yield the best results in the work already under way.

DRUG PLANTS AND SPECIAL PROBLEMS.—The future work of the drug-plant testing gardens will look largely toward the improvement of the plant stock. The services of a skilled plant breeder will add very greatly to the value of the entire drug-plant work. An extension of the testing work in Texas and the opening of a testing garden in the arid Southwest, in order to test valuable drug plants from similar locations in the Old World, are matters worthy of attention. In the hop investigations an effort will be made to extend into additional hop regions the important and very promising improvement work. A thorough laboratory study of hop constituents seems required in order to place this line of work on a sound basis.

The work on perfumery plants, hitherto carried on chiefly as a laboratory study, seems ripe for a wider development. A promising beginning has been made, and the investigations should now be extended in area and scope in order to test the commercial possibilities of some of the more promising crops.

The projects dealing with physiological and fermentation investigations are relatively new and are likely to require some little time before they will begin to show results. The lemon work will be continued, and the coloring of lemons by combustion gases should be tried on a commercial scale in special experimental sweat rooms.

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POISONOUS-PLANT INVESTIGATIONS.—Work on poisonous plants has met with much appreciation from stockmen, especially in the grazing States, and the calls for investigations both in the field and in the laboratory have overtaxed the present resources of the organization. The cooperative work with the Forest Service in the matter of stock poisoning by plants has opened up an opportunity for great usefulness. In order to attain the best results the laboratory work must keep pace with the field investigations.

STUDY OF CROP UTILIZATION.—An important line of work in crop utilization should be undertaken during the ensuing year. Special characteristics are sought by the users of many farm products which go into the hands of manufacturers. The exact nature of these qualities is at times not clearly known to the man who finds difficulty in getting an article having the requirements sought. Between the user with his special needs and the general grower of crops there is an unbridged space. It should be the function of an investigator along this line to learn the requirements of the utilizer in exact and scientific terms, and to study the agricultural conditions under which the crops can be grown to fulfill these conditions. These investigations will be of a technical nature, looking on the one side toward the special demands of the utilizers and on the other toward the agricultural conditions in their bearing on the production of the desired qualities. Investigations in this direction are urgently needed at the present time and could be well combined with the other lines of work of this office.

AGRICULTURAL-TECHNOLOGY INVESTIGATIONS.

The investigations of problems in agricultural technology, including cotton grading and paper-plant investigations, have continued under the direction of Dr. N. A. Cobb, Agricultural Technologist, assisted by Mr. Charles J. Brand, Physiologist, in charge of paper-plant investigations; by Mr. Wingate P. Barbot, Mr. W. E. Chambers, Prof. R. L. Bennett, and Mr. D. E. Earle in cotton standardization; and by Dr. Albert Mann in general technological and microscopic work.

COTTON STANDARDIZATION.

Much time and energy have been devoted to the work on cotton standardization during the past year. Sets of the official cotton grades to the number of 175 have been prepared, of which 25 sets were for preservation in vacuum storage and 50 sets for placing with the principal growers', merchants', and manufacturers' associations in various parts of the country, the remaining sets to be sold. Orders received in advance more than covered all of the sets prepared. The sets so far issued have been received with general favor, so far as is known. In numerous instances highly commendatory letters have been received by the Department concerning them.

METHOD OF PREPARING OFFICIAL COTTON GRADES.—It is believed that the official grades have been prepared with greater care and precision than has ever been attained before in connection with similar work. The object of the officers in charge has been to copy as closely as possible the types submitted by the Committee on National Standards,

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appointed to advise the Secretary of Agriculture in behalf of the cotton interests of the country as to what should constitute the nine official grades. The aim has been to match as exactly as possible the original types deposited by this committee with the Secretary of Agriculture. To accomplish this object much experimenting has been necessary and various expedients have been adopted. Several improvements have been made in the method of preparing the grades. The idea of protecting them by full-size photographs fastened in the cover of each box seems especially to have met with approval.

COMPOSITION OF THE GRADES.—Each of the nine official grades is represented by a box containing twelve individual samples called "types." Care has been exercised to eliminate uncertainties and difficulties in connection with the grades by preparing them in such a way that their appearance and character will change as little as possible with time.

PAPER-PLANT INVESTIGATIONS.

The object of the paper-plant investigations of the Bureau of Plant Industry is to find fibers suitable for paper making that will offer at least a partial substitute for wood, the diminishing supply of which is accurately reflected by its constantly rising price. This substitute is being sought (1) among the waste or by-products of our cultivated crops, such as corn and broom-corn stalks, the stalks of saccharine and nonsaccharine sorghums, rice, flax, and common grain straws, hemp waste, and bagasse; (2) among plants that may possibly be grown with profit especially for paper-making purposes, such as hemp, esparto, jute, okra, *Eulalia japonica*, and several of the standard Japanese paper plants; and (3) among wild plants such as the grasses, rushes, and sedges of our coastal and interior marshes, the canes of the canebrakes, the yuccas, sotols, and certain grasses of the dry Southwest. These investigations include both laboratory and field tests, as well as semicommercial and commercial tests in paper mills.

FIELD AND LABORATORY WORK.—In the field work cornstalks have been produced at selected stations in Kentucky, Iowa, Illinois, and Missouri; broom-corn stalks in Indiana and Kansas; stalks of several varieties of nonsaccharine sorghum at the dry-land experiment farm of the Bureau at Dalhart, Tex., and hemp plants in the hemp-growing sections of Kentucky and Indiana. In addition, numerous other raw materials from cultivated and wild plants have been assembled for tests from other sources. In the production and growing of materials cooperation has been effected with numerous private individuals and with several offices of the Bureau.

In the laboratory preliminary digestions have been made of corn, broom corn, and hemp stalks, rice and flax straw, Colorado River hemp (*Sesbania macrocarpa*), cotton-seed hull fiber, bagasse, esparto, water hyacinth, Poseidonia (an Australian marine plant), saw-grass, and several other materials. The purpose of these preliminary experiments is to furnish a guide for the semicommercial tests at the paper mills. The optimum time of cooking, pressure, chemicals, etc., are here determined, and handmade sheets are produced for examination and testing. All chemical determinations are made in cooperation with the Bureau of Chemistry, and a portion of the preliminary work

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has been done in cooperation with the Forest Service. Facilities have been installed also for the microscopic study of paper fibers, which is now under way.

SEMICOMMERCIAL PAPER TESTS.—In the making of semicommercial tests considerable work has been done during the past year. These tests are made under contract at the Cumberland Mills of S. D. Warren & Co., near Portland, Me. One problem has been met with in connection with most of the raw materials under test, namely, the necessity of removing wholly or greatly reducing the relative proportion of the pith or parenchymatous cells. The long fiber resulting from the separation is suitable for the various grades of book and writing papers, while the pith pulp can probably be used in making paper and pulp specialties.

Paper has now been made in a wide variety of finishes from corn, broom corn, rice straw, and several other materials, both pure and in combination with other fibers, including soda fiber from poplar and sulphite from spruce, and also cotton-hull fiber. Small quantities, or "engines," as they are commonly called, of paper have been made from about eight varieties of Indian corn and four varieties of broom corn to make possible a comparison of the different varieties, both as to yield and as to paper-making qualities. Cotton-hull fiber, the shortest lint that remains adhering to the hulls, which are a by-product of the cottonseed oil industry, used in combination with corn, broom corn, and rice straw papers, has been found to facilitate greatly the draining of the pulp and also to add to the softness of the paper. The rice straw used in the experiments was furnished by the Arkansas Rice Growers' Association. The tests of broom-corn stalks have been especially complete and quite encouraging. All papers produced in the work are tested in cooperation with the Bureau of Standards of the Department of Commerce and Labor.

FOOD EXTRACT FROM CORNSTALKS.—Good progress has been made in the study of the so-called "food extract" obtained by aqueous extraction under pressure from stalks of corn and broom corn and some other crop materials. The favorable results of the chemical analyses of this extract produced on a small scale led, during the past season, to the production of a larger quantity. A vacuum evaporating apparatus was improvised and set up at the paper mill, and sufficient extract of a molasses-like consistency was made to conduct preliminary feeding tests. The results of these tests, which were continued for a month in cooperation with the Bureau of Animal Industry, justify the production of sufficient material, say, 1 to 2 tons, to conduct a decisive feeding test. If the food value of cornstalks in the form of water-soluble solids can be conserved profitably and returned to the farm for feeding, an important point will have been gained. The removal of the raw material will then not represent a serious attack upon our soil resources. It seems possible that this extract may have an important bearing upon the ultimate possibility of cornstalks as paper-making material.

GENERAL TECHNOLOGIC WORK.

Although the cotton and paper work have occupied the major portion of the time of the Office of Agricultural Technology, several problems of a general nature have received attention.

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CROP-INFESTING NEMATODES.—From a study of three main crops of the country it is becoming clear that the number of their nematode enemies, especially those attacking the roots, is so great as to demand immediate further investigation. Hitherto the inquiries on this subject have related largely to the number and nature of the species of nematodes found attacking these crops and the extent of the injury due to their attacks. From a comparison of the specimens thus far examined it is possible to draw certain general conclusions, and these conclusions show the strong advisability of carrying out tests to settle more definitely the nature of the injury caused by a certain class of these pests with a view to devising combative measures. In the future it is proposed to give this work increased attention. Preliminary physiological tests made during the past year have indicated the lines along which the new investigations will have to proceed.

IMPROVED METHODS OF PRODUCING ILLUSTRATIONS.—The installations made in the laboratory for the purpose of producing illustrations and measurements have been further improved and utilized during the past year. The methods first adopted in these installations are being adopted elsewhere. The apparatus so far installed is of the greatest service in connection with the work on cotton standardization and on paper-making plants. These new devices are frequently consulted by experts both in and out of the Department, and explanations of their underlying principles have been made upon request.

FIBER-PLANT INVESTIGATIONS.

The investigations relating to plants producing textile and brush fibers have continued in charge of Mr. Lyster H. Dewey, Botanist. During the past year the work has been devoted chiefly to hemp, flax, sisal, and zapupe.

HEMP INVESTIGATIONS.—Hemp grown on the state farms in Wisconsin in 1909, in cooperation with the state experiment station, has been retted and broken under the direction of this office. The yield and quality of fiber compare very favorably with hemp grown in the bluegrass region of Kentucky. The destruction of Canada thistle, quack-grass, and other weeds by the dense shade of the growing hemp, and the excellent physical condition of the soil after this crop, together with the profits in the cultivation of hemp for fiber, have aroused the interest of Wisconsin farmers. Further experiments are being continued in Wisconsin in 1910, and work along similar lines has been begun in Iowa in cooperation with the Iowa Agricultural Experiment Station.

A study of the history of hemp has shown clearly that all of the best fiber-producing varieties are derived from the giant hemp, "ta ma," of China. Several samples of Chinese seed obtained by the Office of Foreign Seed and Plant Introduction are being carefully tried in order to procure improved varieties.

FLAX INVESTIGATIONS.—More than 1,000 plants were selected in the fiber-flax fields of eastern Michigan in 1909. By careful laboratory tests these were reduced to the 100 best plants. The seed from each one of these was carefully planted in the spring of 1910 in separate plats, and the resulting plants are being subjected to a rigid selection. The

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excellent results obtained by similar selection with other plants, and especially with flax for seed, indicate that improved varieties of uniform flax for fiber may be expected, making it unnecessary to import from Europe flax seed for fiber growing, as has been done heretofore. The increasing demand for linens during the past season, resulting in an improved market for the fiber, has led to a greater interest in the production of flax fiber in this country.

SISAL AND OTHER HARD FIBERS.—The experimental plantation of sisal, henequen, and zapupe near Yauco, P. R., carried on in cooperation with the Porto Rico Agricultural Experiment Station, is showing excellent results in the development of the plants, and plans are being made to harvest some of the leaves for the first crop of fiber during the coming year. An experimental plantation of sisal, cabuya blanca, from Costa Rica, and two varieties of zapupe from eastern Mexico, has been started on one of the Florida Keys. The growth of these plants thus far gives excellent promise of success.

PLANS FOR FUTURE WORK.—Plans are being made for the ensuing year to extend the cooperative work with hemp in order to encourage the cultivation of this crop over a wider area; to cultivate plats of flax for selection at three or more points so as to obtain information regarding effects of soil and climate, and especially to avoid danger of total loss from unfavorable weather conditions in any one place; and to investigate other fiber-producing agaves in Mexico so as to introduce those kinds which are found most promising.

TAXONOMIC AND RANGE INVESTIGATIONS.

The Taxonomic and Range Investigations of the Bureau have continued along the same general lines as heretofore, under the general charge of Mr. Frederick V. Coville, Botanist.

IMPROVEMENT OF FOREST GRAZING AREAS.—As a partial result of the cooperative work with the Forest Service on the improvement of forest grazing areas a report has been published as Circular 178 of the Forest Service, entitled, "The Pasturage System of Handling Range Sheep," by James T. Jardine. It is shown that under this system, when sheep are relieved, not only from dangers due to wild animals, but from the worry and restrictions imposed by a herder and his dogs, the sheep scattered out and fed where they pleased; they selected the grass that suited them best; they chose clean bed grounds; they went to water whenever thirsty and only when thirsty; they wasted far less vegetation by trampling; they fattened more quickly; they did not lose their fat from long drives and the worry of sheep dogs; and they produced a heavier fleece.

As an outgrowth of the coyote-proof pasture experiment already under way, an experiment was begun in the spring of 1910 on the use of 40-acre coyote-proof inclosures for lambing purposes. This experiment was located in the Cochetopa National Forest of Colorado. The experiment begun in 1908 in the Wallowa National Forest of northeastern Oregon on the natural reseeding of destructively overgrazed mountain pasture areas has been brought to a successful conclusion, and a report will be ready for submittal for publication during the present year.

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RELATION OF ACIDITY OF SOILS TO GRAZING PLANTS.—In the progress of the cooperative experiments between the Forest Service and the Bureau of Plant Industry on the artificial reseeding of denuded grazing lands in the National Forests, it had been found in 1908 and 1909 that the failure of certain forage plants on certain experimental areas could not well be attributed to improper conditions of moisture and temperature. On the suspicion that the conspicuous differences of success or failure might have been caused by differences in the acidity of the soil, a study of the acidity of these areas was made in 1910, with wholly conclusive results. It was found that the areas on which Kentucky bluegrass and timothy failed were acid and that on these same areas redtop grew with great success. It was found, on the other hand, that the areas on which redtop made a poor growth and timothy and Kentucky bluegrass succeeded were neutral or slightly alkaline in their chemical reaction. It is clear from the season's study that acidity of the soil is a factor of the greatest importance, hitherto unconsidered, in the seeding of these mountain grazing lands. Hereafter experimental sowings will be made with reference to conditions of acidity as well as those of temperature and moisture.

Fortunately, nature herself has furnished a guide to the acidity of these areas. There are certain wild plants which grow only on acid lands, others which grow only on neutral or alkaline lands, and the presence or absence of these indicative plants is an excellent practical guide for field work. The most trustworthy indicators of acidity are various plants of the blueberry and heather families, especially the species of the genus Vaccinium, known in New England as blueberries, but in the region of most of the National Forests called huckleberries.

DOMESTICATION OF THE BLUEBERRY.—A report entitled "Experiments in Blueberry Culture," by Mr. Frederick V. Coville, has been prepared and is now in press as Bulletin No. 193 of this Bureau. The writer has found by experiment how blueberries differ from ordinary plants in their method of nutrition and in their soil requirements, and by means of this knowledge he has worked out a system of pot culture, under which these plants attain a development beyond all previous expectations. There is good prospect that the application of the knowledge thus gained will establish the blueberry in field culture and that ultimately improved varieties of these plants will be grown successfully on a commerical scale. The blueberry will grow successfully only in acid soils. The most promising situations for experiments in the field culture of the blueberry are either peat bogs or sandy uplands treated with upland leaf peat. The full results of the investigation of blueberry culture are given in the bulletin referred to.

BOTANY OF THE ECONOMIC GRASSES.—The botanical studies of grasses have continued in charge of Mr. A. S. Hitchcock, Systematic Agrostologist. During the past year the work on the genus Panicum, which is the largest genus of grasses in North America and contains such important economic species as hog-millet, Para grass, Guinea grass, and Colorado grass, as well as several sand binders, has been completed and prepared for publication. Memoranda regarding valuable grasses found in different foreign countries are in preparation

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in the form of a card catalogue to be available to the Office of Foreign Seed and Plant Introduction and to agricultural investigators generally. Specimens of grasses and grass seeds have been identified for various offices in the Department of Agriculture, for state colleges and experiment stations, and for numerous private individuals.

ECONOMIC COLLECTIONS.—The work of identifying and preserving record material of the plants introduced by the Office of Foreign Seed and Plant Introduction, in charge of Mr. W. F. Wight, Botanist, has continued in cooperation with that office. The collection is also rapidly increasing through the addition of other economic material, particularly in the groups that are the subject of taxonomic study by members of the office staff. Experience has shown that in working out the relationship and botanical origin of the varieties of cultivated plants a large amount of material, both cultivated and wild, is necessary to establish definitely the range of variation in a given form under varying conditions of soil and climate. Material will be collected during the coming year in connection with field studies on the various groups under investigation.

SYSTEMATIC STUDY OF THE GENUS PRUNUS.—A critical study of the various American species of the genus Prunus is being made. Many orchards have been visited in New York, Maryland, Michigan, Minnesota, Iowa, and Texas, and it is certain that this work will now result in a much more accurate classification of the cultivated varieties of plums than has heretofore been made. It has been found, for instance, that *Prunus nigra* and *Prunus americana* may be readily distinguished, and that each of these species in the western portion of its geographical range is represented by a form more valuable from the horticultural point of view than the eastern and typical form of the species. A form of *Prunus americana* extends as far north as Brandon, Manitoba, and is probably the hardiest American plum so far as ability to withstand extreme winter temperature is concerned, although *Prunus nigra* has previously been supposed to be the hardiest. Another result of this study of American plums that may prove valuable to horticulture is the identification of a variety grown locally in a few counties in Kansas with *Prunus orthosepala*, a species occurring in a few botanical gardens and special collections, the native region of which, however, is not definitely known. It is expected that field work now in progress will result in the discovery of the origin of this species and in securing information that will lead to its further utilization.

It is expected that work on the native American plums will be completed during the present year and that the investigation will then be extended to the Old World species of the genus. As rapidly as practicable other fruits will be taken up and given careful study. Work of the same character on forage plants and ornamental trees and shrubs has also been planned and will be carried to completion as soon as possible.

STUDY OF THE BOTANICAL ORIGIN OF THE POTATO.—The investigation of the origin of the cultivated potato has shown that a number of forms referred by some investigators to *Solanum tuberosum* have well-defined specific characters and a definite geographical distribution, and that the range of *Solanum tuberosum* in a wild state was

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much more restricted than has been generally supposed. One form now used in breeding work for blight resistance has been found to be distinct from any species previously described. Effort is now being made to obtain through the Office of Foreign Seed and Plant Introduction material of all the tuber-bearing species in order that their relationship with the cultivated potato may be accurately determined, and when this material is available it will be possible to bring the investigation to early completion.

INVESTIGATIONS IN BOTANICAL BIBLIOGRAPHY.—The special bibliographical investigations which have enabled the botanical workers of the Department to reach the literature of taxonomic botany with efficiency and economy have been continued, under the direction of the Botanist in Charge, by Miss Marjorie F. Warner and Miss Alice C. Atwood. It is planned to issue a circular of information for the convenience of those wishing to use the catalogue of botanical literature. It is believed that this work will prove of great value to investigators both in and out of the Department.

SEED-TESTING LABORATORIES.

The work of the seed-testing laboratories has been carried on as formerly under the immediate charge of Mr. Edgar Brown, Botanist.

GENERAL LABORATORY INVESTIGATIONS.—While the number of tests made at the Washington Laboratory has increased slightly, no effort has been made to increase the amount of routine seed testing. This laboratory is devoting proportionately more time to the investigational side of seed work along such lines as the study of the distinguishing characters of nearly related groups of seeds; the perfecting of methods of testing for vitality; the value of "hard seeds" and treatment to improve their practical value; the proper condition of storage which will best preserve vitality, including vacuum storage; and other closely related problems.

The examination of forage-plant seeds for the presence of adulterants has been continued. As a result of the publications following such examination the sale of misbranded and adulterated seed has practically stopped, with the exception of Kentucky bluegrass and orchard grass, and the sale of these has been reduced to less than one-fourth of what it was formerly.

WORK OF THE FIELD LABORATORIES.—Three new laboratories were opened during the past year in cooperation with state institutions in Oregon, Indiana, and North Carolina, and those in Nebraska and Missouri were continued. In each of these States an opportunity has been offered farmers, as well as seedsmen, to have seeds examined by experts who give definite information as to the quality of the seeds submitted, including trueness to name, freedom from weed seeds and chaff, and germination. This work has been well received, as is shown by the number of samples of seed submitted for examination, and especially, where the laboratories have been in operation more than one year, the increasing number of samples examined each year. As soon as any State is able to make examinations independently the work will be turned over to it. New cooperative laboratories are to be established in other States where seed testing has thus far received little or no attention.

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GRAIN STANDARDIZATION.

The investigations of the Bureau bearing upon the methods of handling and grading commercial grain have continued in charge of Mr. John D. Shanahan, Technologist, with Dr. J. W. T. Duvel as Assistant in Charge of Laboratory Methods.

COMMERCIAL HANDLING OF CORN.—Various lots of corn, aggregating approximately 50,000 bushels, have been under the control of the Department at various times during the past year through agreement with the owners. The object of this arrangement has been to determine for experimental purposes under actual commercial conditions the relation of the methods of handling to the ultimate condition or grade of the corn. These lots of corn were under observation at regular intervals while in transit from points in the corn belt and while in storage at terminal and export points. Many shipments of various sizes not under the control of the Department were also examined at point of shipment and again at destination. Two cargoes of corn aggregating 275,000 bushels were accompanied to European ports by Mr. E. G. Boerner and Mr. J. H. Cox, assistants, who made observations at regular intervals en route. The quality and condition of corn in cribs on the farm and when marketed at country grain elevators have been studied.

These experiments and observations have yielded much valuable information and a great quantity of data bearing upon the behavior of commercial corn stored in cribs and elevators, in transit by rail and water, the factors influencing such behavior, and the influence of those factors upon the commercial grades and values of corn. The moisture-testing apparatus, which was developed and recommended by the Department, has continued during the year to play an important part in fixing grades and market prices of corn.

WORK WITH WHEAT AND OTHER GRAINS.—The methods of handling commercial wheat from field to mill, including the harvesting, transporting, storing, and grading, have been studied, and approximately 300 samples of the various varieties, classes, and grades were obtained, milled, and baked, in cooperation with the North Dakota Agricultural Experiment Station, in order to study the factors which constitute milling and baking quality, with special reference to the influence of those factors upon the commercial grades and values of wheat. Other commercial grains have been studied along similar lines during the year, special attention having been given to the bleaching of oats with sulphur. Satisfactory cooperation with grain-carrying railroads, commercial exchanges, grain-dealers' associations, and grain-elevator companies has been effected and this cooperation has contributed to the success in acquiring additional valuable data bearing upon the factors which constitute the intrinsic worth of the various grains for commercial purposes and upon which the commercial grades of grain must be based.

The work during the ensuing fiscal year will be continued along the same general lines as heretofore. Experience has shown, however, that certain modifications in methods are necessary in order to bring the investigations to bear more effectively upon the fundamental principles and factors which underlie the intrinsic and economic worth of commercial grains.

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GRAIN INVESTIGATIONS.

The general adaptation, breeding, and other work of the Bureau on grains has continued, as in previous years, under the immediate charge of Mr. M. A. Carleton, Cerealist, and good progress has been made along a number of lines.

WINTER-WHEAT EXTENSION.—Experiments with the different strains of hard winter wheat have been continued even more extensively than during the preceding year, particularly in the western portion of the Great Plains and intermountain districts. The season throughout all the semiarid region has been unusually severe, the summer having been particularly dry and the winter cold in certain localities. The opportunity, therefore, has been good for a test of the Kharkof variety, which had already given indications of being an unusually hardy strain. From experiments so far, two facts appear to have been learned with reference to this variety, namely, (1) that it gives the best comparative results in seasons of extreme drought and cold, and (2) that while on the whole it is a hardier strain than others of the Crimean group, in a number of localities the common Turkey strain gives fully as good results on an average. The total annual production of the Kharkof variety is now probably between 15,000,000 and 20,000,000 bushels.

DURUM-WHEAT INVESTIGATIONS.—The conditions of the past year have been particularly favorable for durum wheat in comparison with common varieties in view of the extreme drought. The superior adaptation of this kind of wheat over others in dry districts has been demonstrated more emphatically than ever before. Work in the development of pure types from the different durum varieties has proceeded as before and several distinct strains have been obtained that are considerably different in their local adaptation. As rapidly as possible these representative strains will be assigned definitely to the districts in which they belong, there being no doubt that the Kubanka, already well known, will remain the important variety for the northern States of the Great Plains.

During the year there has been an unusual amount of correspondence with individuals with reference to the source for obtaining durum-wheat flour, showing a distinct demand among the people for flour of this kind. As heretofore it has been difficult to point out where a good grade of durum flour could be obtained. On the other hand for the entire year there is yet no case on record known to this Department where anyone after trying the flour has been displeased with it. Durum-wheat flour is now commonly used in a number of eastern cities, particularly Baltimore, Washington, and Richmond, a single firm having disposed of five carloads in the last-named city within three months.

PACIFIC COAST GRAIN INVESTIGATIONS.—The demonstration of the adaptation of Chul and Fretes wheats to the San Joaquin and Sacramento valleys in California were mentioned in the last report. It remained to increase the seed of pure strains of these wheats that the farmers might be able to make use of them. This work is going on as rapidly as possible. During the year a number of demonstration trials have been arranged with some of the representative farmers

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in this region. The results of these trials confirm those of our own experiments in showing the yield of these wheats to be much greater than that of the varieties commonly grown.

GRAIN WORK IN THE SOUTHWESTERN PLAINS.—Grain work is done on the experimental farms at Amarillo and Dalhart, Tex. The superintendent of the farm at Amarillo comes in contact with farmers to a considerable extent at different times during the year and is thus able to disseminate among them, through institute lectures and otherwise, a considerable amount of information obtained from the results of our experiments. Over a large portion of this region the season has been the driest of many years, thus giving an unusual opportunity to show the superiority of proper methods of cultivation over those heretofore commonly practiced by the farmers. In all this region winter grains continue to show themselves superior to spring grains, except in the case of oats. The short-season varieties of oats are better than those that require a longer period for ripening, and there is continued proof of the great importance of the sorghums as dependable crops for profit.

INFLUENCE OF ENVIRONMENT ON THE COMPOSITION OF GRAIN.—The environment experiments comprise several series, each consisting in the planting of the same original seed of a variety of grain at three different points and the transfer of enough of the succeeding crop for seed from each point to each of the other two points the following season for the purpose of determining the effect of a change of soil and climate on the composition of the kernel. The past two years' work in this line has given interesting results. In some of these experiments there has been a departure from the results obtained heretofore from wheat, in that the yield from home-grown seed has not been as great as that from seed of the same original source brought from other localities, though the difference was not great. In the soil-transfer experiments conducted in Maryland, Kansas, and California the quality of the wheat produced has been practically the same on each of the three different soils at the same point, though the appearance of the growing grain in the three plats was quite different, and the yields have usually been greater on the western soils.

PRODUCTION OF PURE STRAINS OF CEREALS.—In recent years a critical examination of experimental work throughout the country has shown that many experiments heretofore conducted with considerable pains over a long period of time have been of little value because of the neglect to observe certain fundamental facts in inaugurating the experiments. One of these essentials is the employment of a pure strain of the crop. The Office of Grain Investigations, recognizing this fact, has given much labor to the sorting of so-called standard and introduced varieties, which are really mixtures, and to the development thereby of pure types from a single mother plant. This work has now been carried on far enough for the acquirement of a considerable amount of seed of a number of pure strains. As rapidly as possible the seed of these strains will be substituted for the ordinary seed heretofore used in all of the important field experiments.

CROPS IN ROTATION WITH CEREALS.—The crop-rotation experiments intended to determine what crops should be used in alternation with cereals to obtain the best results have been conducted for several years

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at different points, particularly in California, Kansas, and Utah. All results in the cases where legumes were employed in these rotations have completely confirmed the results of other experiments heretofore conducted in showing the importance of such crops preceding wheat. In California the value of green rye turned under in preparation for wheat seeding was also shown. Both rye alone and a mixture of rye and vetch plowed under green were followed by a yield of 50 bushels of wheat per acre, being 22 bushels more than that obtained on summer fallow, and 35 bushels more than where wheat followed wheat. At several of the dry-land experimental farms two years' experiments have been conducted with potatoes as a crop to precede wheat. The idea is to determine whether a cultivated crop, such as potatoes, could be substituted for summer tillage, even where the rainfall is very deficient. It seemed first necessary to determine whether the potato crop itself would be sufficiently profitable to justify its cultivation.

TIME AND RATE OF SEEDING GRAINS.—For a number of years experiments have been conducted at a number of the experimental farms operated by this office to determine the best time of seeding for the different small grains and the proper amount of seed to sow to the acre. As one important result of general application, after several years' work, it is shown that a considerably smaller amount may be employed in the drier districts than in the humid areas. The proper amount of wheat, for example, is an average of somewhere near 3 pecks, while in the humid portions of the eastern United States it is common to sow from 5 pecks to 2 bushels. From the experiments on time of seeding no general conclusion can yet be drawn which will be applicable to all of the experimental farms.

DRY-LAND GRAIN INVESTIGATIONS.—During the past year dry-land investigations were conducted, as heretofore, under the immediate charge of Mr. W. M. Jardine, Agronomist. The field assistants at each of the experimental farms, ten in number, are acquiring increasing familiarity with the needs of the work and the investigations are rapidly becoming more effective. During the year one new farm has been added, at Moro, Oreg., which is conducted in cooperation with the state experiment station. This farm comprises about 250 acres of tillable land fairly representative of the whole of eastern Oregon and eastern Washington, and it has been supplied with the necessary equipment for experimental work. In all of the work facts are being obtained each year concerning the best time for seeding the different crops, the proper amount to sow to the acre, proper methods of cultivation for the conservation of moisture, the crops best adapted for cultivation in alternation with grains in order that the latter may give the best yields, the best varieties of each crop to grow, and other cultural conditions. The very unusual dryness this season throughout almost the entire dry-land farming region gave an excellent opportunity to demonstrate the value of the methods being employed on the different experimental farms for the conservation of moisture and in determining the varieties best adapted for dry seasons. In Utah the drought was particularly severe and the possibilities for grain production in that district. through proper methods of farming, have been thoroughly tested.

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GRAIN-SORGHUM INVESTIGATIONS.—The work with dry-land grain-sorghum crops has continued in charge of Mr. Carleton R. Ball, Agronomist. The season of 1909 was marked by intense drought during July, August, and September in the grain-sorghum belt. Excellent opportunity was afforded to study the adaptability of different varieties to such conditions. Dwarf and early varieties of kafirs and milos produced 25 to 60 per cent of their normal yield, in comparison with ordinary larger and later varieties which produced, on an average, 10 to 25 per cent of their normal yield. Such droughts probably occur on an average of once in three years. Merely as a form of drought insurance, the Great Plains farmer is advised to plant some of these more drought-evading varieties each year, even if he prefers larger and later varieties for other reasons. Planting the ordinary varieties at about one-half the usual rate per acre will permit fair grain production even in dry years.

Experiments have been continued with Sudan durra and Blackhull kowliang. The durra showed itself to be a fair producer under conditions of drought. The Blackhull kowliang is still regarded as highly promising, but progress has been retarded by numerous field hybrids due to natural crossings because of the limited space available.

A considerable number of chemical analyses of different varieties have been made in cooperation with the Bureau of Chemistry, and many more are now in progress. There is considerable variation in the fat content and protein content of different varieties and different strains. The maximum protein content found was 16.6 per cent and the average 12.2 per cent, which is higher than the average for corn varieties. In conjunction with the cooperative milling laboratory of the Office of Grain Standardization, preliminary experiments in milling some of the best varieties of grain sorghums have been started. It has been shown that an excellent quality of meal, comparable with corn meal, can be produced. Cooking tests made in a small way show attractive results with the meal, and demonstrate also that the flour can be used in mixtures.

RICE INVESTIGATIONS.—During the past year rice investigations, in charge of Mr. Charles E. Chambliss, Expert, have been continued and extended. Experiments have been begun at Beaumont, Tex., and an assistant has been stationed there to look after the experimental work. Much satisfaction has resulted from the experiments at Biggs, Butte County, Cal., indicating the possibility of profitable rice cultivation in that region on a commercial scale. An important feature now is to determine the varieties best adapted and the best methods of soil preparation and of handling the crop.

Experiments were continued in South Carolina in the investigation of rice blast, and arrangements have been made for more extensive and thorough work in that district. Attempts to obtain earlier maturing and higher yielding strains of rice are being continued. A series of experiments is now under way to determine the effects of change of soil and climate on the yield and composition of rice grown from the same original seed.

CEREAL RUSTS, SMUTS, AND OTHER DISEASES.—In the cereal-disease work, in charge of Mr. Edward C. Johnson, Pathologist, further researches into the life history and physiology of rusts have been made and the relations between meteorological conditions and rust epidemics explained. Papers have been prepared on the causes of floret

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sterility of wheats in the Southwest, and on the relationships and distribution of timothy rust, which has recently become an important disease. Results promising briefer and simpler treatments for the prevention of loose smuts in wheat and barley have been obtained. A Bureau circular on the smuts of sorghum has been revised and improved preventive measures have been recommended.

Particular attention has been given to the breeding of rust-resistant grains. Numerous new crosses between the rust-resistant durums and the common bread wheats have been made, and the selection and fixing of types from crosses made in 1907 have been continued.

OAT INVESTIGATIONS.—Work in the investigation of oats has continued under the immediate charge of Mr. C. W. Warburton, Agronomist. Breeding work with spring oats in the Middle West and with winter oats at the Arlington Experimental Farm has been conducted along the same lines as in previous years. Some excellent strains of spring oats, quite different from any now in cultivation, are being developed, the result of hybridization between the Clydesdale oat and a variety of the Rustproof type imported from Asia Minor. Preliminary tests show them to be desirable in size of grain, yield of grain, and stiffness of straw. Hybrids of the Sixty-day crossed with Burt promise some good strains of early oats, while somewhat later, large-grained types with good straw are being developed from hybrids between Sixty-day and Clydesdale and Sixty-day and Probsteier. In winter oats the most promising pedigreed selections so far are those derived from the Culberson and Red Rustproof.

The methods of producing and handling oats in common use among farmers have been studied rather extensively during the past few years in connection with experimental work on all phases of oat production, and the results of these studies have now been presented in a series of bulletins. One of these has been devoted exclusively to the methods of growing winter oats in the South, where considerable interest has been aroused in the past few years in the production of winter small grain.

BARLEY INVESTIGATIONS.—The work with barley, conducted by Mr. H. B. Derr, Agronomist, has continued along three general lines, the introduction of new varieties, the improvement of existing varieties, and the production of improved strains by hybridization. Excellent results have been attained during the past season from some of the newly introduced barleys. Gaitami, introduced from Manchuria, ripens one week to ten days earlier and is outyielding the other six-rowed barleys in the Northwest. Several hull-less varieties are also very promising. Good results have been accomplished in improving the yield and quality of barley by means of selecting the seed. This method is simple and can be practiced by any intelligent farmer. A circular has been issued on the subject entitled "The Selection of Seed Barley by the Specific Gravity Method."

Experiments have been continued with the awnless winter variety of barley. This barley resembles the Tennessee Winter variety and from all indications it will be as hardy and yield fully as well. It will be a valuable addition to the crops of the South where hay grasses do not succeed very well. A hooded hybrid barley has also been produced that gave an excellent yield under field tests the past season.

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PLANS FOR FUTURE WORK ON GRAIN CROPS.—The unfinished lines of investigation which have been described will be carried forward during the ensuing year. The work in the production of pure types of different cereals will be continued and an effort will be made especially to increase the seed of those already established to such an extent as to be of use in general cultivation.

The hardiest winter wheats will be given still more severe tests to determine, if possible, the limit of their endurance in resistance to drought and cold. In the work with durum wheat an attempt will be made to obtain still more definite results on the adaptation of local varieties, and special attention will be given to the encouragement of the use of durum-wheat flour by baking tests and otherwise.

Efforts will be made to make more available to farmers the results of experiments with grains on the dry-land experiment farms. Such experiments as seem necessary will be added to obtain as much further knowledge as possible concerning the effect of legumes, potatoes, and other cultivated crops upon the yield of cereals when grown in alternation with them. Experiments to determine the proper time of seeding in the vicinity of the different experiment farms will be emphasized.

In the work with sorghums special attention will be given to the trials of kowliang varieties, determinations of the commercial uses of sorghums, and the improvement of milo and kafir with reference to drought resistance and the shortening of their growing period. In rice investigations it is expected to obtain much more information on the adaptation of varieties, particularly in new districts such as California and Arkansas. Methods of rice cultivation and the life history of rice blast will also be investigated. Experiments for the development of hardy winter varieties of oats and barleys will be emphasized, as well as for promoting greater yield and quicker maturity. It is expected also to obtain further information as to the hardiness and uses of Black Winter emmer and the proso millets.

CORN INVESTIGATIONS.

The general corn investigations of the Bureau have continued in charge of Mr. C. P. Hartley, Physiologist, assisted by Messrs. Curtis H. Kyle, Ernest B. Brown, and L. L. Zook.

ACCLIMATIZATION OF HIGH-YIELDING STRAINS.—The cross-bred strains, the foreign introductions, and the pure-bred strains of corn that have been undergoing acclimatization and selection for higher yields by this office for periods of six to nine years continue to respond to improvement in adaptation, yield, and quality. U. S. Selection 77 has been undergoing improvement by the Department in cooperation with a local farmer at Piketon, Ohio, since 1902. In 1909 the average yield of 740 acres of this corn was 77 bushels (70 pounds dry ears per bushel) per acre, some fields averaging 100 bushels to the acre. This corn is adapted to river-bottom lands of southern Ohio, Indiana, and Kentucky. U. S. Hybrid 120, produced in 1902 by crossing Hickory King and Boone County White, is undergoing improvement at Round Hill, Va. It is a large-kerneled, white dent corn, adapted to upland conditions of northern Virginia. U. S. Selection 133 is a ninety-day yellow dent corn that has given

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excellent satisfaction in the southern half of Wisconsin and of Michigan. U. S. Selection 136, introduced from Mexico in 1904 by Dr. S. A. Knapp, has been under process of acclimatization and improvement in production at Waco, Tex., for six years in cooperation with local corn growers. It is now grown by farmers about Waco, Brownsville, and other portions of Texas, and to some extent in Arizona and southern California. It continues each year to produce best, or second best, in comparison with other introductions, cross-bred and pure-bred types, with which it is tested in dry, hot localities.

TESTING METHODS OF CORN BREEDING.—The various methods of corn breeding that have been put to practical tests during the past ten years are showing their comparative merits. The yields of this fall will show the relative production of corn that has been undergoing improvement by different methods of close breeding and crossing. It is well established that the retention of half the seed of ears tested as to production is important. It allows further testing under different seasonal conditions and isolation or crossing of individuals of improved merit. Indications have been found that power to yield well is with corn a Mendelian character and that when two homozygous individuals, related or unrelated, are mated the progeny produces heavily.

DETERMINATION OF MOST PROFITABLE VARIETIES.—Tests of production made during the past year in cooperation with about 500 farmers have brought forth many reports showing greatly increased yields from well-selected and well-adapted strains of corn. Corn growers desirous of making accurate tests to ascertain what variety can be most profitably grown are furnished with advice, as well as record blanks, and in certain localities seed of some of the improved varieties developed by the Department.

PLANS FOR FUTURE WORK ON CORN.—The gratifying and valuable results that have followed the production by breeding and adaptation of high-yielding strains of corn make an extension of the work desirable. It will not be possible for the corn-breeding experts of the Department to breed high-producing strains for each locality, but it is desirable that their broad knowledge and experience be utilized in producing such strains in distinct portions of the United States. Such strains can be taken up by private corn breeders for more local adaptation, as is now being done with the strains already developed. There is need for an extension of corn-breeding work into the rich delta country of the lower Mississippi River, into Pennsylvania, New York, the rich muck lands of Florida, the semiarid regions, and the extreme Northwest. Such work would greatly increase the profit on the acreage already devoted to corn in those sections.

TOBACCO INVESTIGATIONS.

SCOPE OF THE INVESTIGATIONS.

During the past year the tobacco investigations of the Bureau, in charge of Dr. W. W. Garner, Physiologist, have included work with most of the principal cigar, manufacturing, and export types, covering ten of the leading tobacco-producing States. The work has been confined to the established tobacco districts and no effort has been

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made to extend the industry into new territory. In some of the districts which have received considerable attention in the past the investigations have been discontinued in order to take up work in other tobacco sections in which nothing has previously been done.

There are three fundamental problems included in the tobacco work, as now organized, one or more of which are receiving attention in each of the districts in which investigations are being conducted. These problems are: (1) Tobacco-breeding investigations and variety tests; (2) fertilizer experiments, qualitative and quantitative; (3) crop-rotation experiments and demonstrations. The breeding investigations include a study of the fundamental principles which need to be applied in the improvement of the crop by breeding and selection, as well as the practical work of developing better varieties and strains for the different tobacco sections. In some cases this feature is limited to a comparative study of local varieties. The extensive fertilizer experiments under way are for the purpose of determining the best sources of plant-food elements for the various types of tobacco and the most profitable quantities to be applied from the standpoints both of yield and of quality. The crop-rotation work is designed to collect data based on direct experiments and to afford practical demonstrations as to the most profitable systems for use where tobacco is the leading money crop, with due consideration given to the special requirements of the crop as regards quality. In addition to these three general lines of investigation a number of special problems in harvesting, curing, fermentation, the control of diseases, etc., receive attention in those districts where such work is most needed.

In conducting the investigations along the lines indicated above, field stations are maintained in representative districts producing contrasted types of tobacco and at each station the work is shaped to meet local conditions. The investigations are so planned, however, that the breeding, fertilizer, and crop-rotation studies in each section shall not only supply necessary information bearing on the local situation but shall also contribute data for reaching important generalizations, the work in each locality thus fitting into a general scheme with definite objects in view. Correlation of the results of the work systematically followed up will form a substantial basis for the introduction of more profitable and permanent systems of farming with tobacco as the central money crop.

INVESTIGATIONS IN CIGAR-TOBACCO DISTRICTS.

During the past year studies with cigar types have been carried out in the States of Massachusetts, Connecticut, New York, Ohio, and Texas. Work has also been begun in Pennsylvania in cooperation with the state experiment station.

FERTILIZER AND CROP-ROTATION EXPERIMENTS.—In the broadleaf belt of the Connecticut Valley, the yield has been falling off in recent years, and fertilizer experiments, mainly with various forms of phosphates, have been undertaken for the purpose of restoring the former large yields. In New York experiments have been undertaken in cooperation with the state experiment station to develop the best systems of rotation and the most profitable use of fertilizers for the tobacco crop of the State. In Texas an experiment farm has

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been established at Nacogdoches for working out and demonstrating in a practical way to farmers the best systems of rotation and fertilizing the soil for growing filler tobacco as an additional money crop in conjunction with cotton and the other crops adapted to that section.

BREEDING INVESTIGATIONS.—The special study of the fundamental principles of tobacco breeding has been continued in the Connecticut Valley and some of the results of the work will be ready for publication at an early date. The practical work in this section for the present is the development of a broadleaf hybrid analogous to the Halladay Havana originated by the Bureau. In Ohio some very productive filler hybrids developed in the course of the breeding investigations in cooperation with the state experiment station are being tried out commercially in cooperation with growers. In Pennsylvania breeding investigations for improving yield and securing greater uniformity in the filler crop have been inaugurated in cooperation with the state experiment station.

STUDIES ON CURING, FERMENTATION, AND CONTROL OF DISEASES.—The laboratory studies on the important changes effected in the curing and fermentation processes have been practically completed and the results are being prepared for publication. Much interest is being manifested by growers in the Connecticut Valley in the process which has been devised for the use of artificial heat in curing and which will remove the danger from pole sweat and also insure more uniform curing.

The new process of harvesting tobacco by picking the leaves from the stalk is becoming more important in the Connecticut Valley and is of special interest, because of the fact that the new Halladay tobacco does not cure well on the stalk. The merits of the new process are being carefully tested this year in both the Havana and broadleaf districts. The value of the method of sterilizing seed beds with steam, devised by the Bureau for the control of root-rot, has been again emphasized by serious outbreaks of the disease in beds which were not subjected to this treatment.

INVESTIGATIONS IN MANUFACTURING AND EXPORT TOBACCO DISTRICTS.

During the fiscal year just ended experiments and demonstrations with manufacturing and export types of tobacco have been carried on in the States of Maryland, Kentucky, Virginia, and North Carolina. Some preliminary work has also been undertaken in the bright flue-cured district of South Carolina. The three essential features of the work with all these types are fertilizer tests, crop-rotation experiments and demonstrations, and variety tests. Local stations are maintained in districts producing the important types of leaf, and the general features of the work, as well as the special problems taken up, are adjusted to local requirements.

WORK IN VIRGINIA AND MARYLAND.—In Virginia the investigations have been continued largely along the lines followed in the past, and local stations have been maintained at Appomattox and Rustburg in the dark-fired district, at Louisa and Bowling Green in the sun-cured district, at Chatham and Axton in the bright flue-cured district, and at Fork Union in the dark-stemming district. The institutes

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held at these stations, which form an important feature of the work, have been largely attended by farmers. Not only are the farmers showing their interest in the investigations by attending the institutes, but they are putting into practice the lessons drawn from the experiments and demonstrations, and there is a marked demand for the extension and further development of the work. The investigations in Virginia are conducted in cooperation with the state experiment station, and a special appropriation of $5,000 is made by the State in support of the work.

In Maryland the investigations have been continued along the same lines as last year, with headquarters at Upper Marlboro and subsidiary centers at Lyons Creek and La Plata. These investigations are being conducted in cooperation with the state experiment station.

Work in North Carolina and South Carolina.—The work in the so-called "new belt" of the bright flue-cured district of North Carolina, which was begun last year with headquarters at Greenville, in Pitt County, has been continued in cooperation with the State Department of Agriculture. In addition to the fertilizer experiments, crop-rotation studies, and variety tests, a special feature receiving attention in this section is the relation of commercial fertilizers to the burning quality of the tobacco. There has been considerable complaint in the trade that much of the tobacco produced in this district does not burn freely, and it seems likely that the system of fertilizing is largely responsible for this trouble. During the coming year it is planned to extend the general features of the work into the "old belt" of the bright flue-cured district and the darker tobacco district of the State. A problem of vital importance to the tobacco industry of the old belt, more particularly in Granville County, is the control of the Granville wilt. This problem has been taken up in cooperation with the state experiment station both from the standpoint of breeding resistant varieties and of developing systems of rotation, fertilizing, and cultivation which will control the disease.

The work which has just been begun in South Carolina, with headquarters at Manning, Clarendon County, will be along the lines followed in North Carolina.

Work in Kentucky.—The investigations at Lexington (in the Burley district), at Hopkinsville (in the dark-fired district), and at Hardinsburg (in the Green River district) have been continued; and, in addition, experiments have been undertaken at Bowling Green (in the one-sucker district), in cooperation with the West Kentucky Normal School. All of the work in this State is in cooperation with the state experiment station..

PLANT-NUTRITION INVESTIGATIONS.

These investigations, in charge of Dr. W. W. Garner, Physiologist, relate to some of the fundamental problems in plant nutrition of a general nature as distinguished from the nutrition work of the Bureau which has reference to specific crops. These studies include laboratory researches supplemented by practical field tests which are carried on in the Piedmont area of North Georgia, in the Coastal Plain section of eastern South Carolina, and on the Arlington Experimental Farm.

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RELATION OF NUTRITION TO THE COMPOSITION OF THE PLANT.—Experiments are in progress to determine the factors controlling the production of the important constituents of crop plants, with special reference to the influence of the various elements of plant food on nutrition and composition. During the past year particular attention has been given to the quantitative production of oil in such plants as cotton and soy beans. These plants offer many advantages for investigating the relation of the factors of nutrition to the amount of oil produced, and very satisfactory progress has been made on these problems. There is much need for information on this important subject and it is believed that the results of the investigations now in progress will aid in a better understanding of the underlying principles involved.

FUNCTIONS OF THE SECONDARY ELEMENTS OF PLANT FOOD.—The aim of this study is to acquire more definite information regarding the rôle of some of the mineral elements which are commonly regarded as of little practical importance, but which may perform very important functions in influencing the nutrition of the plant. The practical question involved is as to the relative value of the so-called high-grade and low-grade mineral fertilizer salts for feeding crop plants. A series of field tests are being conducted to determine in a practical way whether the secondary constituents of the low-grade fertilizers play any important part in the nutrition of the plant, either direct or in the maintenance of a physiological balance with the most valued elements of food supplied.

MOST FAVORABLE NUTRITION RATIOS FOR CROP PLANTS.—Although a knowledge of the optimum nutrition ratios for different crop plants is of fundamental importance to practical agriculture, little exact information on the subject is to be had, mainly for the reason that no satisfactory methods have been available for determining these ratios. The work under this head for the present, therefore, has to do primarily with the development of methods whereby the various disturbing factors of environment may be controlled, so as to make it possible to determine the relative quantities of the important elements of plant food actually required to produce definite crop yields, not only with respect to gross yields, but also with reference to the more valuable crop constituents. It is hoped that a series of experiments now in progress will demonstrate the efficiency of a proposed method of procedure for acquiring reliable data on this subject.

DRY-LAND AGRICULTURE INVESTIGATIONS.

The investigations in dry-land agriculture in the Great Plains area, under the direction of Prof. E. C. Chilcott, Agriculturist, have progressed along the lines outlined in previous reports.

THE SEASON'S RESULTS.—The season of 1910 has been a particularly favorable one for obtaining results from the various rotations and methods of cultivation. The seasonal precipitation has been normal or less than normal at all stations; and at some, notably Amarillo and Dalhart, Tex., Williston and Edgeley, N. Dak., and Bellefourche, S. Dak., the drought has been severe. The results of the various

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methods of tillage have been consistent and in general accord with the results of previous years. A bulletin is now in press containing the most important results and tentative conclusions reached in the investigations up to the close of the year 1909.

Summer tillage and alternate cropping have generally given larger yields than continuous cropping or crop rotations. These increased yields have not generally been sufficient, however, to make the practice of summer tillage profitable when the extra cost of this system as compared with rotation or green manuring is taken into consideration. In some instances quite as good yields have been obtained from properly planned rotations as from alternate cropping and summer tillage. Green manuring has also given excellent results in many instances.

DEVELOPMENT OF THE WORK.—The interest shown by the local farming communities in the work of the several stations is very gratifying, and it is believed that this phase of the work can be still further developed to the mutual advantage of the farmers and the station workers. It is planned to strengthen the work in crop rotation and cultivation methods by increasing the number of rotations, using fertilizers of various kinds, and in other respects more fully meeting the local demands which have become more apparent since the work was begun. The close and cordial cooperative relations which have heretofore existed with other offices and with several of the state experiment stations have been continued, and there is urgent need of still further extension and coordination of these cooperative relations.

No new stations have been established nor have any been discontinued during the past year. It is deemed desirable, however, to extend the work to one new station at Hettinger, N. Dak., in cooperation with the North Dakota Agricultural Experiment Station. It is also hoped that the entire work may be strengthened by employing an additional traveling field assistant to aid Mr. J. S. Cole, Expert, in that important work. The staff now engaged in the work includes J. M. Stephens, Special Agent; Fritz Knorr and O. R. Mathews, Experts; and W. W. Burr, E. F. Chilcott, O. J. Grace, A. L. Hallsted, F. L. Kennard, C. H. Plath, J. C. Thysell, and W. O. Whitcomb, Assistants.

WESTERN AGRICULTURAL EXTENSION.

The Office of Western Agricultural Extension, under the direction of Mr. Carl S. Scofield, Agriculturist, has been engaged during the past year in the operation of a number of field stations for the Bureau of Plant Industry at various points in the Western States. With the exception of the station near San Antonio, Tex., these field stations are located on reclamation projects of the Department of the Interior. The lines of work underway have had to do with local problems of crop production. By cooperative arrangement much of the investigational work conducted at these field stations is planned and, to a certain extent, supervised by members of the investigational staff of the Bureau. It is the aim to make these stations the centers for the investigation of local crop and tillage problems and to apply the results of scientific investigation by actual field practice in the various localities. Four of the stations, which will be first mentioned

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in the paragraphs which follow, have been in operation for three years or more, while work on the other stations was inaugurated during the summer of 1909.

YUMA EXPERIMENT FARM.—The Yuma station, of which Mr. W. A. Peterson is superintendent, includes 154 acres of land, 7 miles north of Yuma, Ariz., on the California side of the Colorado River. The experimental work, which up to the present year has been conducted on rented land south of Yuma, has now been brought together on this new experiment farm. The different lines of work under way include Egyptian cotton, dates, miscellaneous forage crops, various kinds of fruits, and experiments with eucalypts in cooperation with the Forest Service. Owing to the necessity of clearing and preparing for irrigation all of the land required for the experimental work this year, the work has been considerably impeded. The station is now fairly well developed, however, and the experimental work will go forward rapidly.

TRUCKEE-CARSON EXPERIMENT FARM.—The Truckee-Carson station, of which Mr. F. B. Headley is superintendent, is located on the Truckee-Carson project of the Reclamation Service, 1 mile south of the town of Fallon, Nev. The station farm includes 160 acres of land, of which about 50 acres have been leveled and put under ditch. Cooperative experimental work with forage crops, cereals, corn, horticultural and truck crops, and forest trees has been continued during the year. New lines of cooperative investigational work dealing with the causes of the infertility of the raw desert land have been begun during the past year. These investigations include studies of the bacterial flora of the soil and of certain physical and physiological phases of plant nutrition. Experiments in the application of fertilizers have also been started.

SAN ANTONIO EXPERIMENT FARM.—The San Antonio station, of which Mr. S. H. Hastings is superintendent, includes 125 acres of land, 5 miles south of San Antonio, Tex. The lines of cooperative investigational work mentioned in previous reports have been continued, with added emphasis during the past year on studies of native plants related to the cultivated fruit and nut trees. The aim of the work at San Antonio is chiefly to determine what crops and what tillage methods are likely to produce the best results without irrigation. The season of 1909 was the driest year recorded during a period of over thirty years; consequently an excellent opportunity was afforded for determining the efficacy of improved methods of tillage and the relative value of various crops. The most significant feature of the season's work was the demonstration of the value of a prolonged fallow period preceding crop production. Land that had lain fallow and had been thoroughly cultivated for twelve to eighteen months prior to cropping in 1909 gave very satisfactory yields of corn, sorghum, and cotton, while other land which had lain fallow for a much shorter period produced practically no crop. The difference in soil moisture content in the two fields appeared to be hardly sufficient to account for the difference in yields. Experiments have been begun to determine what factors other than available moisture supply contributed to these observed differences in crop yield resulting from a longer period of fallow.

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BELLEFOURCHE EXPERIMENT FARM.—The Bellefourche station, of which Mr. Beyer Aune is superintendent, includes 200 acres of land, 2 miles northeast of Newell, S. Dak., on the Bellefourche project of the Reclamation Service. Prior to July 1, 1909, this field station was operated by the Office of Dry-Land Agriculture Investigations. Four important cooperative lines of work are being conducted at this station, namely, (1) experiments in crop rotation and tillage methods, (2) drought-resistant crop-breeding investigations, (3) drought-resistant cereal investigations, and (4) experiments (in cooperation with the Forest Service) with forest trees for fuel and windbreaks. Up to the present time no water has been available for irrigation purposes on this farm. It is expected that irrigation water will be available during the summer of 1912.

KLAMATH EXPERIMENT FARM.—The Klamath station, of which Mr. J. P. Irish, jr., is in charge, includes 40 acres of reclaimed swamp land, 14 miles southeast of Klamath Falls, Oreg. The work at this station was begun at the special request of the Reclamation Service, to ascertain the probable agricultural value of this reclaimed swamp land. No cooperative investigational work has as yet been started at this station.

HUNTLEY EXPERIMENT FARM.—The Huntley station, of which Mr. J. M. Stephens is acting in charge, includes approximately 200 acres of land, 4 miles east of Huntley, Mont., on the Huntley project of the Reclamation Service. The work so far undertaken has been largely demonstrational, with a view to showing how best to produce standard field crops in that region. Sugar beets, potatoes, wheat, oats, barley, and alfalfa planted in various ways have been given different kinds of tillage. Work at this station is being conducted with the informal cooperation of the Montana Agricultural Experiment Station.

UMATILLA EXPERIMENT FARM.—The Umatilla station, of which Mr. R. W. Allen is in charge, includes 40 acres of land, 2 miles north of Hermiston, Oreg., on the Umatilla project of the Reclamation Service. The chief lines of work have to do with horticultural and truck crops. The station is conducted in cooperation with the Oregon Experiment Station.

MISCELLANEOUS COOPERATIVE WORK.—In addition to the field stations mentioned, cooperation with the North Dakota Agricultural Experiment Station is in effect in certain phases of the experimental work on the substation at Williston, N. Dak., on the Williston project of the Reclamation Service. A portion of the Williston farm is irrigated land, and an assistant familiar with crop production under irrigation is employed to supervise the experiments with field crops under irrigation. Another assistant is employed to supervise experiments being conducted at Williston in connection with crop rotation and tillage methods.

On the North Platte project of the Reclamation Service, near Mitchell, Nebr., this office is also cooperating with the Office of Dry-Land Agriculture Investigations in the operation of a field station known as the Scottsbluff Experiment Farm, which is being conducted jointly by the Bureau of Plant Industry and the Agricultural Experiment Station of Nebraska.

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PLANS FOR FUTURE WORK.—It is expected during the ensuing year to materially extend the cooperative investigational work on some of the newer field stations operated by this office; and if the necessary arrangements can be effected, it is proposed to establish another field station on one of the projects of the Reclamation Service in New Mexico.

ALKALI AND DROUGHT RESISTANT PLANT BREEDING.

The work of breeding crop plants resistant to alkali and drought and of investigating the physiological factors of alkali resistance and drought resistance has been carried on as heretofore under the direction of Mr. T. H. Kearney, Physiologist. Good progress has been made during the past year in breeding improved strains of Egyptian cotton for growing in the arid Southwest, in breeding drought-resistant strains of forage plants for the Great Plains area, in determining from the physiological point of view what constitutes drought resistance, and in working out correlations between the natural vegetation and the capabilities for drought-resistant crop production of different types of land in the arid portion of the country.

EGYPTIAN COTTON IN THE SOUTHWEST.—The work on Egyptian cotton is conducted in cooperation with the offices of Western Agricultural Extension, Crop Acclimatization and Adaptation, and Crop Physiology and Breeding Investigations. As a result of the plant-breeding work to date, three distinct types have been developed from the seed of the Mit Afifi variety of Egyptian cotton, with which the acclimatization and breeding experiments were begun eight years ago. Two of these are so distinct from the parent stock as to constitute new varieties. They have light-colored fiber and more nearly resemble some of the other Egyptian varieties, such as Nubari and Jannovitch. The third has all the characters of Mit Afifi, including the characteristic brown-colored fiber, but is more productive and produces fiber of better quality than does the imported seed. This acclimatized Mit Afifi and also one of the new varieties were grown last year on a field scale in Arizona and showed a remarkable degree of uniformity in the characteristics of the plants and fiber. The three best types are being tested this year in several localities in Arizona and California in order to determine to what degree they retain their uniformity and other desirable characteristics under a variety of climatic and soil conditions.

As a result of the work in 1909 it was proved that the diversity which had previously shown itself in this acclimatized Egyptian cotton could be reduced to a minimum by growing carefully selected strains and removing the undesirable plants from the field before flowering. It is evident that by these methods a product can be obtained having the uniform staple demanded by spinners of these high-grade cottons. In view of the present relative scarcity and high price of Egyptian and other long-staple cottons, it would seem desirable to ascertain as soon as possible whether the growing of these new cottons can be made commercially successful in the Southwest. Meanwhile the plant-breeding work will be continued at various localities in that region, to develop locally adapted strains of the most promising varieties.

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DROUGHT-RESISTANT PLANT BREEDING.—The best of the selected strains of alfalfa developed at Bellefourche, S. Dak., in the course of this work continue to show great uniformity in their desirable forage type and in seed production, both at Bellefourche (S. Dak.) and at Akron (Colo.). This uniformity has been particularly noticeable in connection with one of the strains, seed of which was grown at both places. The very dry weather of June, 1910, has given the first severe test of drought resistance which has been had during the last three years. Most of the selected strains have so far stood the test satisfactorily. If the conditions of drought continue, an adequate test of the resistance of the improved strains of sorgo and millet that have been bred can be made. A study of several hundred individual plants of *Bromus inermis*, grown in hills in the breeding nursery at Bellefourche, showed that a number of distinct types could be selected, one of which is especially satisfactory as a forage plant. This grass is showing remarkable resistance to the prevailing conditions of drought, and considerable difference in this respect is manifested by the different types. Further study of the individual plants of western wheat grass in the nursery shows abundant opportunity for the selection of desirable forage types of this highly drought-resistant native grass. Seed of such of the new strains of the crops mentioned as prove to be definitely superior in drought resistance will be increased as rapidly as possible for distribution in the regions to which they are adapted.

PHYSIOLOGY OF DROUGHT RESISTANCE.—Under the immediate direction of Dr. H. L. Shantz, Physiologist, and in cooperation with the Physical Laboratory, numerous varieties of most of the important crop plants grown in the Great Plains area are being studied in order to ascertain what structural and physiological peculiarities make some species and varieties more drought resistant than others. Parallel work is being carried on with the native plants of the region, in which the drought-resistant characteristics are usually more easily distinguished. It is found that the best adapted of the cultivated plants, as well as most of the native plants, fall into two classes—those which endure drought and those which merely escape it.

Experiments with a large number of species and varieties seem to indicate that there is little difference in the ability of the roots to take up water from a given type of soil when nearly dry, the minimum percentage of soil moisture permitting the roots to absorb being nearly the same for all the crop plants investigated. Among plants which are really drought resistant the two principal factors appear to be ability to withstand wilting by reducing transpiration in times of drought, and ability to recover and continue growth after wilting, when water again becomes available.

It is found that many plants which are generally considered drought resistant merely avoid drought by making a comparatively small growth of leaves and stems, thus conserving soil moisture. Other plants, by ripening their seeds rapidly, escape the extremely dry weather of the latter part of the summer. Another adaptation by which some apparently drought-resistant plants in reality escape drought conditions is by the development of deeper or more extensive root systems, which enable them to draw water from a larger volume of soil.

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INDICATOR VALUE OF NATURAL VEGETATION.—As a result of three years' field work in a portion of the Great Plains area it has been possible to work out detailed correlations between the native growth on different types of land and the capabilities of those types for crop production. It is found that land which is naturally covered with short grass is best adapted to shallow-rooted and early-maturing crops, such as small grains, and that while such land gives the largest yields in years of heavy and well-distributed rainfall, it is most subject to drought in years when the precipitation is light or confined to the early part of the summer. On the other hand, land covered with a vegetation of the taller and deeper rooted wire grass, or of the still larger bunch grass and species of similar habit, is well adapted to deep-rooted crops and such as require a longer season for maturing. While production on lands of the tall-grass types is relatively smaller in wet years than on short-grass land, it is much surer in dry years.

The physical reasons for these correlations are that moisture penetrates deeper and is held longer in wire-grass and bunch-grass types of land than in short-grass land. It was very gratifying to observe during the extreme drought of 1910 that the predictions based upon previous studies of the structure and physiology of the natural vegetation on these different types of land as to their relative adaptability to different crops and their relative productivity in times of drought have been abundantly fulfilled. This year the best crops were generally grown on the wire-grass and the bunch-grass land, while crop failures have been more numerous on the short-grass land which yielded so well in 1909, the wet year. It is proposed to continue this work in order to ascertain what modifications of these correlations will be necessary in order to make them applicable throughout the Great Plains area.

PHYSICAL INVESTIGATIONS.

The work of the Physical Laboratory, under the direction of Dr. L. J. Briggs, Physicist, is largely cooperative in character. During the past year cooperative work has been carried on to a varying extent with about one-half of the offices in the Bureau.

The principal lines of investigation have had reference to the growth of crops in dry-land regions, such work having been conducted in cooperation with several of the offices of the Bureau. The object has been to determine what method of crop rotation and cultivation are most efficient in securing penetration of the rainfall and in preventing evaporation. Special attention has also been given to a study of the climatic conditions at each of the dry-land experimental farms of the Bureau to determine the effect on crop production. The subject of evaporation has been given particular attention, since the amount of rainfall required is dependent upon the amount of evaporation taking place. Several bulletins have been prepared during the year giving the results of various lines of cooperative work.

FARM-MANAGEMENT INVESTIGATIONS.

The Farm-Management Investigations of the Bureau have continued during the past year under the direction of Prof. W. J. Spillman, Agriculturist, with few changes in the problems investigated

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or the methods involved. The most important changes relate to the establishment of satisfactory cooperative relations in this new type of work with several of the state experiment stations. During the year there has been a marked increase in the demand for representatives of the Office of Farm Management as speakers at farmers' meetings. While considerable institute work of this character has been done, it has not been allowed to interfere with the regular field work, but, on the other hand, has been helpful in the latter work by bringing the representatives of the Department into closer contact with farmers in the regions where agricultural problems are being investigated.

SOUTHERN FARM-MANAGEMENT DISTRICTS.

The farm-management work in the South was continued during the past year under the direction of Mr. D. A. Brodie, Agriculturist. Several additions to the staff engaged in the work were made.

WINTER LEGUMES FOR THE SOUTH.—Special attention has been given during the past year to the establishment of winter legumes throughout the South as a means of putting humus into the soil and of preventing leaching and soil washing during the winter season when the soil is usually bare. These crops also make a beginning toward the production of feed for live stock, and are thus expected to have an important effect upon the types of farming which apparently must prevail in the South when the agriculture of that section is established on the best possible basis. General interest has been aroused on the part of farmers in these winter legumes, as well as in other winter crops. The demand for seed of bur clover, hairy vetch, and crimson clover for sowing in cotton fields and elsewhere last fall was so great that the total supply of these seeds was exhausted early in the fall.

In the vicinity of Columbia, S. C., hairy vetch has become fully established as a farm crop. A single farmer grew 100 acres of oats and hairy vetch last winter and harvested the crop for hay and silage to be fed to dairy cows. This crop has assumed importance in other localities. Bur clover has become well established as a farm crop in the vicinity of Talladega, Ala., and large acreages of it were sown there last fall. The common vetch has similarly become a standard farm crop in De Soto Parish, La. All these crops have been sown more or less generally in the South where seed could be obtained. An effort has been made to increase the supply of seed of these crops by teaching farmers how to grow them. Bur clover seed is easily produced in the South, and at present prices is a very profitable crop. Another section of the Office of Farm Management is encouraging farmers in certain parts of Michigan in the production of hairy-vetch seed, not only as a means of enriching the soil but of acquiring increased income, and the results are very promising as well as highly important to the southern farmer. Seed of the common vetch is grown abundantly in Oregon. Farmers in that section consider 2¼ cents a pound a fair price for the seed. As freight on this seed from Oregon to the Southern States in carload lots is not more than three-fourths cent a pound, it is probable that when the supply is sufficient this seed can be laid down in the Southern States at a price not to exceed 3 cents a pound.

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SOY BEANS FOR OIL PRODUCTION.—In certain parts of the South the farmers have been encouraged in the production of soy beans as a possible substitute for cotton seed in the production of oil. The cotton-seed oil mills are able to extract the oil from these beans by means of the same machinery and methods used in extracting cotton-seed oil, and the soy-bean seed is in demand especially in those regions where the area of cotton has been cut down because of the ravages of the boll weevil. In cooperation with the Office of Forage-Crop Investigations, a study is being made of the adaptability of the various varieties of soy beans to the sections where there is a demand for them. Some of the varieties under trial are very promising. In addition to their value as oil producers, the vines and the cake made from the seeds in expressing the oil are important sources of feed for live stock.

ALFALFA IN THE SOUTH.—In the demonstration work, especially in South Carolina, many successful fields of alfalfa have been established. Heavy inoculation with soil from an alfalfa field has been found in many cases to be the determining factor of success with this crop. In some places where soil was easily available for inoculation purposes, farmers have applied as much as five wagonloads per acre, with excellent results.

The spread of alfalfa culture on the black prairie soils of Alabama and Mississippi during the past year has been one of the most marked changes occurring in southern agriculture. For several years past the acreage of alfalfa sown in that region has increased enormously, mainly as the result of efforts made by representatives of this Department in cooperation with state institutions. Where alfalfa has become established the land has more than doubled in value. As alfalfa is one of our most important forage crops, we are teaching farmers in this section the principles involved in cropping systems for live stock, and there is a remarkable increase in the interest manifested by farmers in stock farming. Many cropping systems have been devised for southern farmers entering upon some kind of live-stock farming.

On certain soils in the western part of the cotton belt root rot has made serious ravages on the cotton crop, and also attacks most leguminous crops, especially alfalfa. In regions where this trouble prevails it has been found possible to grow alfalfa fairly satisfactorily for about two years. Methods have also been worked out by another office of this Bureau which make it possible to grow a number of leguminous crops on land affected by root rot, and a number of demonstrations have been instituted on farms in such regions in order to teach the farmers how to utilize these principles and at the same time follow cropping systems that are satisfactory and profitable.

LESPEDEZA, OR JAPAN CLOVER.—Another leguminous crop that has attracted much attention in the South recently is lespedeza, or Japan clover. This plant has spread all over the South during the past half century, being found generally along roadsides and in waste places. The usual method of utilization has been as summer pasture. Recently, however, in the study of farm experience a number of farmers have been found who have learned how to introduce this crop into a rotation. Special attention has been given to the experience of

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these farmers, and it has been found that the crop is eminently adapted to rotation farming where the soil is suitable and that it produces hay of high quality.

NORTHERN FARM-MANAGEMENT DISTRICTS.

The farm-management work in the Northern States has continued in charge of Mr. C. B. Smith, Agriculturist. As in the South, special attention has been given to the improvement of cropping systems followed by the farmers. Many improved cropping systems have been devised and put into operation with resulting benefit to the farmer. These cropping systems have become centers of interest for communities needing instruction in farming. In several instances farm-management associations have been organized in order that the demonstration work might reach larger numbers of individuals than is possible without such organizations.

DEMONSTRATION WORK IN NEW YORK AND NEW ENGLAND.—On the hilly lands of southern New York, which have been exhausted by unwise systems of management, demonstration work has been conducted during the past year. On many farms good crops have been grown by the farmers under the direction of experts representing jointly the agricultural department of Cornell University and the United States Department of Agriculture. It has been determined both by experiment and by the study of farm practice that by the application of sufficient lime clover can be grown on these depleted soils. With good tillage and good seed large crops of potatoes have been grown under our direction where formerly this crop was altogether unprofitable. Varieties of corn have been introduced which grow successfully on these hills where corn has not been grown before.

In certain parts of the State of Maine enormous quantities of commercial fertilizers are used. Many farmers buy ready-mixed fertilizers when it is known that by buying the ingredients separately and mixing them on the farm a large saving can be effected. During the year demonstration work on the home mixing of fertilizers has been conducted, not less than 1,200 persons being present at the demonstrations. This work has been done in cooperation with the University of Maine.

CLOVER MANAGEMENT.—One of the most important discoveries made in the study of farm practice in the Northern States during the past year relates to methods of management of clover in corn-belt rotations. The results of this study will be given in a bulletin soon to be published. The evidence accumulated indicates that, in many regions at least, the failure of the clover seeding is due to the fact that the soil easily bakes and forms a crust on the surface, which kills the young clover plants soon after germination. This condition of the soil is believed to be due mainly to a lack of sufficient humus. Many instances have been found where good catches of clover have been obtained by means of a mulch of straw, leaves, manure, etc., which prevents the formation of a soil crust.

CROPS FOR CUT-OVER LANDS.—In the northern part of the States of Wisconsin, Michigan, and Minnesota there are large areas of cut-over lands which are now being brought under cultivation. Much of this land is sandy and the ordinary methods practiced on loam and clay

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soils result in failure here. A careful study has been made of the experience of hundreds of men who have attempted to farm these sandy soils, and the information obtained in this study indicates quite clearly the method by which certain types of farming can be made successful in the region. Hairy vetch has been found to be eminently adapted to these soils. It promises to become important as a seed crop. We have also ascertained the methods by which red clover can be profitably grown on these soils for the production of seed. This method is outlined in bulletins which are already available for distribution. The sandy soils have proved to be adapted to potato growing when proper methods are followed.

DIVERSIFIED FARMING IN NORTH DAKOTA.—The Red River Valley of North Dakota has long been known as a region of single-crop farming based on wheat. In recent years weeds have become troublesome and yields are unsatisfactory. Many farmers in that section have for several years been experimenting with other crops and other types of farming. A careful study of the experience of these farmers who have been trying to break away from single-crop wheat growing has shown several lines of departure that promise success. It has been shown that cropping systems involving legumes are well adapted to the region. The cropping systems devised for that region are quite unlike those familiar farther east, and their success shows the importance of working out systems based on experience in the region concerned instead of trying to adopt systems worked out elsewhere under different conditions.

STUDY OF TYPES OF FARMING.—Special attention has been given in a number of States, particularly in Iowa, to the distribution and adaptation of the various types of farming. In regions where general farming has long been practiced the farmers have for the most part worked out the main problems involved in practice. In this study it has been possible in many cases to determine the reasons for the distribution of the various types of farming met with in our investigations. For instance, it is well known that a large part of the supply of timothy seed for this country is produced in southern Iowa. Studies in that section have shown that the reason why timothy is so largely confined to a definite region in that section is that the locality is one needing drainage but presenting special difficulties in carrying out systems of drainage. The land is too wet to be well adapted to corn and clover. Many farmers in the section have attempted to drain their farms with unsatisfactory results. Evidently drainage is a critical problem in this region. This matter has been brought to the attention of the branch of the Department which has charge of drainage investigations, and is now under investigation by that office. If a satisfactory solution for the problem is found the work of the Office of Farm Management will then be to teach new types of farming in place of the present rather unprofitable one of growing timothy seed for sale.

COOPERATIVE WORK IN MISSOURI.—In the State of Missouri a farm management association has been formed with over 200 members. Each member is attempting to revise his system of management along lines suggested by representatives of this office who are working in cooperation with the agricultural department of the state university. In several sections of the State careful detailed plans have

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been drawn for particular farms, and these plans have been put into operation. On these farms the cost of every phase of management is being studied in detail. Many of the best farmers in the State are adopting cropping systems and methods recommended by the joint representatives of this Department and the state agricultural college.

WESTERN FARM-MANAGEMENT DISTRICTS.

The farm-management work in the West is under the general direction of Mr. Levi Chubbuck, Expert. In certain sections investigations have been in progress for several years with excellent results.

STUDY OF WESTERN FARMING CONDITIONS.—The problems of the West differ from those of any other section of the country because of the difference in conditions. Farming is new in many sections of the West, and in only a few localities have the problems involved in farm practice been worked out and stable forms of agriculture adopted. Exploitive types of farming are still quite general. In many localities these exploitive methods of farming have been highly profitable because of the inherent richness of the virgin soil, but even in these sections the soils are becoming exhausted and the types of farming are changing.

A careful study of farm practice in the Great Plains region has been made during the past four years and the results have recently been submitted for publication. During the past year attention has been given to the problems confronting new settlers on recently reclaimed sandy lands along the Columbia River in Oregon and Washington. Important conclusions were drawn from the results of farm experience and methods worthy of recommendation were recently published in a circular of this Bureau.

FARM PRACTICE WITH SUGAR BEETS.—During recent years a serious situation has arisen in regions where the sugar beet is grown. In the vicinity of many factories the average yield of beets is less than 7½ tons per acre. In order that sugar beets may compete with other crops the average yield must be not less than 10 tons per acre, and the best authorities say that an average of 12 tons is necessary to render it certain that farmers will grow sufficient beets to enable the factories to run on full time. A study of farm experience has been undertaken to ascertain the conditions necessary for producing satisfactory yields of this crop. This study has shown that in many places new lands recently put under irrigation are lacking in humus and therefore in producing power for such crops as these. It has been shown that men who grow beets in rotation with forage crops, keep live stock, and make proper use of the manure thus produced obtain good yields of beets. In some instances yields of over 20 tons to the acre have been obtained. In this work we are cooperating with the Office of Sugar Plant Investigations of this Bureau, which conducts experimental work with this crop.

STUDIES OF FARM PROBLEMS.

In addition to the general district work already referred to, the Office of Farm Management is engaged upon a number of lines of investigation bearing upon various matters of farm management or farm practice.

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FARM PLANS.—In connection with the district work Mr. J. W. Froley, Assistant, is charged with the working out of details of farm plans submitted by the officers in charge of that work. During the year 64 such plans have been drawn and many of them put into operation. The farms upon which these plans are carried out become demonstrations in improved systems of farm management and centers of interest for their respective localities.

FARM ORGANIZATION AND OPERATION.—The work on farm organization and operation has been somewhat interrupted during the year by the resignation of Mr. W. A. Peck, under whose direction these investigations had been conducted for four years. Mr. E. H. Thomson has been placed in charge of this work. During the year detailed daily reports have been received of every hour of labor performed on nearly one hundred farms, and records have been made that enable the office to determine the distribution of this labor between various enterprises on each of these farms. This work has been conducted mostly in cooperation with state experiment stations, especially with those of Ohio and Wisconsin. Arrangements have now been completed for similar work in cooperation with the agricultural department of the University of Missouri. In this work data are being collected from many States regarding the cost of every phase of farm management. These data will later become the basis of determining the profits of various farm enterprises under widely different conditions. In some instances the annual summaries of such data which the office has been able to furnish to the owners of the farms reporting have resulted in important changes in the system of management whereby the profits have been largely increased.

During the past year a careful farm survey has been made in four townships in southern New Hampshire. This survey has dealt mainly with the profits from each of the farms included in the survey. It involves a study of the relation of profit in farming to the type of farming followed, the educational advantages which the farmer has enjoyed, and other considerations. The results obtained in this survey are of unusual value, and will be presented in a bulletin which is now in press. This work will be considerably extended during the ensuing year.

FARM EQUIPMENT.—Investigations of farm equipment conducted by Mr. L. W. Ellis, Assistant, during the past three years, have been continued; but Mr. Ellis resigned February 28, 1910, and Mr. H. H. Mowry was appointed to succeed him. Recent interest in farming on the part of city men has made data concerning the character and cost of farm equipment a necessity. Men of this class who are going to the farm in large numbers are demanding information concerning the cost of beginning business and the nature of the equipment necessary. Special attention has been given during the past year to the character and cost of the necessary equipment on small farms of types suited to the beginner with small capital. During the past four months 86 such farms have been studied in minute detail. This work is to be extended as rapidly as conditions will permit.

PRICKLY-PEAR INVESTIGATIONS.—Work in the culture of prickly pears has been continued during the past year under the direction of Dr. David Griffiths, Agriculturist, as outlined in the last report.

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A special effort has been made to bring into condition for breeding investigations the plantations at Chico, Cal.; San Antonio, Tex.; and Brownsville, Tex., as it is becoming more and more apparent that breeding is a necessary part of this work. As a basis for such investigations, a large number of species are being grown from seed to determine the faithfulness with which these plants reproduce through breeding, and how much variation is to be looked for in such propagation. The indications are that prickly pears, which are generally supposed to be exceedingly variable and badly hybridized, breed true from seed. In March and April about 9 tons of spineless pear cuttings were distributed, mostly to the warmer sections of the country. The past severe winter demonstrated that the area mapped as possibly being adapted to the culture of these plants in Bulletin 140 of the Bureau of Plant Industry must be cut down at least 25 per cent. This applies especially to the Gulf Coast region, from Texas to Florida. In California the winter was quite severe. All varieties of spineless pear except the large, glaucous, blue-green forms of the *Opuntia robusta* group, which are slow growers, were more or less injured, but the majority of the species at Chico, Cal., recovered with only about 5 per cent of loss of cuttings. In some portions of the State they were too badly frozen to recover, except from the roots.

Since the past winter was a very severe test, the plants can be said to be an economic possibility in the interior valleys of California. At Falfurrias, Tex., they were but slightly injured, but the winter was not severe in that section. The present indications are that spineless prickly-pear culture in Texas will be confined to the region lying south of the Texas-Mexican Railway, and it is possible that it can not be grown in some portions of this area.

A survey of the prickly-pear region of Texas has been instituted to determine the extent and importance of native spiny pear feeding at the present time. Data already collected show conclusively that dairy and other cattle produce well with no other roughage.

RANGE INVESTIGATIONS.—Doctor Griffiths has also continued his investigations relating to range management. The results of investigations upon the Santa Rita National Forest in Arizona have been published since the last report in a bulletin of this Bureau. Experimental grazing has been begun during the past year under the immediate supervision of a representative of the Department. Cutting and removing the annual growth of grass is being carried out upon other tracts in cooperation with ranches. Other portions are being continued without stock for purposes of comparison.

A study of range forage is being continued as time permits in connection with other field work, as is also the special study of the more strictly winter sheep pastures of the country, to determine the productivity and best methods of handling them.

In the West and Northwest studies of special areas of native pasture lands, which are being handled in a definite way and which have been under observation for a number of years, have been continued. A report on these studies will be ready for publication in the near future. This report will also include data on the effect of seeding upon mountain meadows and dry hillsides in three or four widely separated, distinct, and typical regions.

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WEEDS AND TILLAGE.—Investigations of weeds and of tillage practises, with special reference to methods of controlling weeds, have continued, as in the past, under the immediate charge of Mr. J. S. Cates. Two years ago a careful study was made of the agronomic habits of the perennial morning-glories or bindweed. The experience of farmers who had learned how to control this weed was also carefully investigated, and methods which had been found by farmers to be effective were described in a Farmers' Bulletin in order that others might give them a trial. At the present time about 100 farmers are trying these methods under the direction of this office. Their practicability is thus receiving a thorough test.

Demonstrations are in progress with a view to eradicate both wild onions and Johnson grass by means of methods which were devised in this office on the basis of studies of the agronomic habits of these weeds. So many successful demonstrations of these methods have been conducted that there is no longer any doubt as to their efficiency, but it seems to be necessary in all sections where these weeds are found to make public demonstrations of eradiction in order to convince farmers of the practicability of these methods.

Studies of the manner of growth of quack-grass, which has long been a serious pest in New England and is now rapidly spreading in the Middle West, have shown that the agronomic habits of this weed are similar to those of Johnson grass in the South. Last year experiments were begun to determine whether the same methods used in the eradication of Johnson grass would suffice for quack-grass. This office is able to report at the present time that the same methods are applicable. The results will be prepared for publication during the current year.

Studies have shown that ordinary annual weeds common on poorly managed farms in all sections of the country are of more economic importance than the dreaded perennials, such as Johnson grass, quack-grass, wild onions, etc. Methods of controlling or exterminating most of the perennial weeds have already been worked out. We are now giving much attention to the study of the ordinary incidental weeds, most of which are annuals or biennials. Our investigations thus far indicate that the control of these weeds is largely a matter of adopting satisfactory systems of farm management, including properly planned rotations and the adoption of methods of tillage which will prevent these weeds from ripening seeds. We are giving special attention to the relation of weeds to various crop rotations and the systems of farming based on them.

Work on the relation of weeds to the tillage needs of corn has been greatly extended during the present year. Demonstration work along this line is in progress on 160 farms in 32 States. These investigations have given important and unexpected results which will be published during the current year.

HAY INVESTIGATIONS.—The most important feature of the hay investigations of the past year, in charge of Mr. H. B. McClure, relates to the possibility of curing hay by artificial drying. In our experimental work alfalfa hay dried in twenty minutes in a kiln retained the original green color of the plants growing in the field, and was greatly relished by stock. A kiln specially adapted to drying hay has been constructed and was recently operated in a few trial runs

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with very satisfactory results. It is expected that this kiln will be in full operation before the end of the present alfalfa season. The results thus far obtained are promising and are of interest especially to alfalfa growers in humid regions. The relative palatability of kiln-dried hay as compared with ordinary hay will be determined before these investigations are finished.

FARM PRACTICE IN THE USE OF COMMERCIAL FERTILIZERS.—During the past year Mr. J. C. Beavers has continued his work in the study of farm practice in the use of commercial fertilizers along the lines indicated in the report for last year. This work has been completed for the South Atlantic States and the results have been published in a Farmers' Bulletin.

PRODUCTION OF FORAGE FOR LIVE STOCK.—Mr. J. S. Cotton has continued his studies of farm practice in the production of forage for live stock. His recent investigations have revealed important changes in the methods used by farmers in beef-feeding sections. These changes have been made necessary by the increased price of grain. Feeders are now using much larger quantities of hay and silage and making corresponding changes in their cropping systems. There is also a larger use of bluegrass pastures than formerly, because of the cheapness of making gains on good pastures.

A careful study has been made of methods of pasture management and of the resulting effects on the production of forage on pasture lands, especially in the New England States. The pastures have been found to be greatly denuded. In many places they have been rendered practically worthless for pasture purposes. It is believed that the principal causes of these conditions are (1) that cattle are turned upon the pastures too early in the spring, and (2) that too many cattle are kept on a given area. The grasses are thus unable to make a vigorous growth and have no opportunity to store up energy in the fall of the year for growth in the spring. This treatment, long continued, has killed out most of the good pasture grass, and as a result weeds have taken its place. It is probable from the information we have obtained that it would require 10 acres of average New England pasture to support one cow five months. The solution of this important problem is being sought in the experience of the relatively few farmers who have maintained their pastures in good condition. Experiments on certain points of pasture management have been recommended to the State experiment stations and to the Office of Forage-Crop Investigations of this Bureau.

CASSAVA INVESTIGATIONS.—Cassava investigations have continued during the past year as in former years, in charge of Mr. S. M. Tracy, Special Agent. Cassava is ordinarily propagated from cuttings of the stem or canes. To keep these canes over winter in the Gulf Coast region has proved to be a difficult matter. During a recent severe winter the crop was almost exterminated in that region by the loss of the canes during the winter season. What seems to be a satisfactory method of keeping these canes has been discovered and practiced for the past three winters by Mr. Tracy. This method will be published in the near future. In former reports the fact has been mentioned that efforts are being made to produce varieties of cassava that can be propagated from seed. These efforts have been successful.

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LOGGED-OFF LAND INVESTIGATIONS.—The work of gathering data relating to logged-off lands has continued during the past year in charge of Mr. Harry Thompson, Expert, in cooperation with the Washington Agricultural Experiment Station, the Washington State University, and the agricultural experiment stations of Wisconsin and Minnesota. A great mass of additional data has been gathered concerning the practicability and cost of methods now in use. Important facts have been ascertained concerning the use of blasting materials. Some promising new methods for burning stumps have been devised. These methods appear to be cheaper than the use of powder and the donkey engine, although they are slower. They seem to be especially adapted for use by men of small capital who can do their own clearing on their own land. Full details of the results obtained in these investigations will be given in bulletins to be published during the current year. It is expected that this work will be brought to a close near the end of the present fiscal year.

PLANS FOR FUTURE WORK.—No radical changes are contemplated in the lines of work now in progress in the Office of Farm Management. As conditions permit, it is expected that the farm-management district work, the farm-survey work, and the investigations relating to cost accounting on the farm will be extended into sections other than those where they are now conducted.

FARMERS' COOPERATIVE DEMONSTRATION WORK.

The Farmers' Cooperative Demonstration Work, under the direction of Dr. S. A. Knapp, Special Agent, has been further extended during the past fiscal year. Within that period the number of agents employed in the work has increased from 322 to 437, while the number of counties in which the work is being conducted has increased from 312 to 455. During the season of 1909, 12,500 boys and more than 52,000 men were under instruction. In the season of 1910, 46,000 boys are in the boys' corn clubs under direct instructions from this office, and approximately 65,000 men are also working under instruction. Preparations are being made still further to extend the work in the fall of 1910.

RESULTS OF THE WORK IN 1909.—Careful and accurate reports have been obtained from a large number of those instructed during the season of 1909, to ascertain the results of the work as compared with the ordinary farming methods used in the same community. Regardless of the adverse weather and climatic conditions prevailing throughout the South during the season of 1909, the results obtained have proved very satisfactory. Everywhere largely increased yields of cotton and corn have resulted from the improved methods worked out by this Department, as compared with the yields obtained under ordinary methods.

CLIMATIC AND WEATHER CONDITIONS IN THE SOUTHERN STATES.—The season of 1909 and the spring of 1910 have both been peculiarly adverse seasons from the crop standpoint. The spring of 1909 saw a large emergence of the boll weevil over the major portion of the territory infested, and especially is this true of southern Mississippi and

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the entire State of Louisiana. Until July the season had much more than normal rainfall east of Texas, followed by a general and continued drought lasting until late in the fall. In parts of Louisiana the droughts did not commence until later, and the extreme rains produced a condition which prevented the farmers from getting into their fields to carry out the instructions given them. There were many other causes besides the weevil to reduce the crop in Mississippi and Louisiana in 1909, such as lack of labor, reduced acreage, floods, extreme rains, and other conditions. The spring of 1910 was an unusual one in that the entire South enjoyed warm weather in the month of March to such an extent as to indicate an early season. This was immediately followed by rains and the killing frost of April 25 and 26, 1910, which was general in southern territory except the immediate Gulf coast. Following the frosts were continuous and heavy rains until late in the month of July, making it difficult for the farmers to properly cultivate their crops.

INFLUENCE OF THE WORK.—One of the greatest things accomplished by the Farmers' Cooperative Demonstration Work in 1909 and the spring of 1910 has been the full restoration of confidence in the entire boll-weevil territory. During the season of 1909 a valiant effort was made in Mississippi and Louisiana to prevent the planters and farmers from becoming panic-stricken, and to prevent them from plowing up their crops or abandoning them to the weevil. The results accomplished in 1909 have been so marked that confidence has been absolutely restored and the farmers and business men generally throughout the boll-weevil territory are working with every confidence in the result, in spite of the adverse weather conditions confronting them. In this victory the Department has enjoyed the assistance of the business interests of the entire boll-weevil section. Merchants and bankers in some localities have even gone so far as to refuse advances to farmers unless they agree to follow the methods and practices advocated by the Department of Agriculture. In accomplishing this result not a little credit is due to the fact that during the season of 1909 there were literally thousands of farmers in badly infested boll-weevil territory who made better than an average crop of cotton by following the Department instructions in localities where no crop was made by persons who failed to follow such instructions.

DIVERSIFICATION OF CROPS.—Throughout the entire Southern States covered by this work there has been a marked tendency toward diversification of the agricultural interests in a territory where formerly cotton was almost the sole cash crop. For example, while eastern Texas under boll-weevil conditions is not raising quite so much cotton in the aggregate as formerly, cotton is still largely grown, and in addition the home supplies are being produced. For the first time the farmers have been able to produce corn and hay for shipment, and this section is fast becoming one of the great fruit and truck raising districts of the country. Prominent and reliable business men and farmers of eastern Texas declare that this territory was never so prosperous as at present, and that their farmers have learned to produce cotton in spite of the boll weevil,

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to raise other crops for commercial purposes, and to produce all their home supplies. Confidence has been absolutely restored, and bank deposits made by farmers have been fully 25 per cent greater than ever before in the history of that section. The same is largely true of northern Louisiana, where for the first time not only corn but hogs have been shipped to outside markets. Large crops of peanuts, cowpeas, and other forage crops have been raised.

THE CORN CROP.—The large number of very successful demonstrations on corn carried on by Doctor Knapp in the Southern States for the past two years have resulted in a large increase of acreage in the production of corn in these States. The increase in acreage in corn in the eleven Southern States was 2,808,000 in 1909 over 1908, and 2,322,000 in 1910 over 1909. Out of 7,100 demonstrators from whom accurate reports were obtained there were 23 demonstrations which equaled or exceeded 100 bushels per acre in yield of corn during the season of 1909, and 936 demonstrations which equaled or exceeded 50 bushels per acre; all this in a year when ordinarily the weather conditions tended to a reduced production per acre. The confidence that the people of the South have gained in their ability to produce their own corn is resulting in a marked interest and increase in the production of hogs and cattle, horses and mules.

DEMONSTRATIONS AMONG NEGROES.—All classes of farmers in every locality, without regard to color, are being instructed. It is noteworthy that many of the agents in this work are instructing negro demonstrators as well as whites. Work is also being done among independent negro farmers in certain localities in the South where the population is largely made up of negroes who own their own farms. In such instances a negro agent is employed who works entirely among the negro farmers. Cooperation with the various negro schools and colleges is maintained in all of this work. There are at present three negro agents in Virginia, three in South Carolina, one in Georgia, four in Alabama, one in Mississippi, and one in Oklahoma.

COOPERATION IN THE WORK.—In addition to the funds appropriated by Congress for the Farmers' Cooperative Demonstration Work, the General Education Board of New York has annually appropriated a liberal amount for cooperation with this Bureau. The amount so appropriated has been increased from year to year by the board and is being expended in the States of Georgia, Florida, South Carolina, North Carolina, and Virginia, while the funds appropriated by Congress are used in the States of Alabama, Mississippi, Tennessee, Louisiana, Arkansas, Texas, and Oklahoma. In all of the work the agents employed are under the direct supervision of Doctor Knapp, representing the Bureau of Plant Industry.

So great has been the hold that the work has obtained that local organizations throughout many of the Southern States are cooperating with the Department in the extension of the work. Sums of money are being expended through local boards of trade, county organizations, and even appropriated by state legislatures, all of which is brought into direct cooperation with the work carried on by the Department and is assisting the Bureau in extending the work

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into territory which could not otherwise be reached. It may be said that this tendency is general throughout the region covered by this work.

SEED AND SEED SELECTION.—Through the local agents of the Department and local organizations a large quantity of well-selected seed has been distributed. Meetings have been held in a large number of communities for the purpose of drawing special attention to seed selection. Many of these meetings are held in the field at the time of the maturing of the crop and practical instructions are given at this time by the agent to the farmers under his immediate supervision. In territory where there is no good seed the Department has either distributed or assisted in obtaining seed in order to start the growing of prolific types of corn and cotton well adapted to that particular locality. The result of this campaign was such that in the spring of 1910 there was probably the largest planting of selected seed, both corn and cotton, ever known in the South.

IMPROVED TOOLS.—One of the most striking results of this work has been the great demand for improved implements among the farmers of the South. More horsepower and better tools for preparing the seed bed and the cultivation of the crop has been Doctor Knapp's constant advice to the southern farmers, with the result that the demand for two-horse breaking plows, disk plows, section harrows, side harrows, diverse cultivators, and, in fact, any kind of implements with which level and shallow cultivation can be done has been very great and in some sections beyond the ability of the dealers to supply.

BOYS' CLUBS.—As previously stated, an increasing interest has been awakened in the boys' demonstration work carried on in cooperation with the public schools. The number of boys directly enrolled, as already referred to, now exceeds 46,000. In the fall of 1909 four winners of state prizes in the South received from private sources, as a part of their reward, a free trip to Washington, D. C., where they were presented with diplomas by the Secretary of Agriculture as a reward of merit for their good work. This has resulted in a similar prize of a trip to Washington being offered in every Southern State, and great interest has been aroused in these friendly contests in the production of corn. It is also noteworthy that in many places where the farmer can not be reached primarily the Department has been able to reach him by enlisting his boy in the boys' corn clubs. It has been found that one year's experience of the boy in the corn clubs has almost universally resulted in enlisting the father as a demonstrator in better farming the next year, and this is true even where the father had declined to cooperate before his son was enrolled in the boys' contest and had proved the value of the improved methods.

PUBLICATIONS.—Aside from the large number of orders for Farmers' Bulletins of the Department handled through the Office of Farmers' Cooperative Demonstration Work, printed instructions to all the farmers and boys under instruction have been prepared and sent out. The number of such circulars distributed during the past year has been upward of 1,250,000. Circular letters of instruction covering special points not covered by the general circulars have also been issued.

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ARLINGTON EXPERIMENTAL FARM AND HORTICULTURAL INVESTIGATIONS.

The general supervision of the Arlington Experimental Farm and of the Horticultural Investigations has been continued as in previous years by Prof. L. C. Corbett, Horticulturist. The general plan of the work of these branches has not been modified, but decided progress and development have marked the year.

THE ARLINGTON EXPERIMENTAL FARM.

The value of the farm at Arlington as an adjunct to the bureaus and offices of the Department conducting investigations is well attested by the use being made of its facilities by the various branches of the Department service.

WORK OF VARIOUS BUREAUS ON THE FARM.—The investigations in progress at the farm under the immediate control of the Forest Service and the Bureaus of Entomology, Chemistry, and Soils, are for the most part a continuation of work already under way. The Forest Service, in addition to maintaining its osier willow holt, has devoted much time and space to the problems of seed germination. This work has been conducted in the greenhouse at the farm. The Bureau of Soils has also increased its work by inaugurating a series of fertilizer tests to learn the effect of the three important elements of plant food—nitrogen, phosphoric acid, and potash—both singly and in combination on plant growth. The area occupied by these four branches of the Department aggregates 15 acres.

The Bureau of Plant Industry has increased its work on the farm during the year. Nineteen offices of the Bureau are conducting investigations on areas set aside for the purpose. About 85 acres are at present required for this work, for which the farm provides facilities such as tools, implements, and labor. The work of the Bureau on the farm embraces cultural, seed selection, plant breeding, and pathological problems with the principal forage, grain, fruit, and truck crops, as well as special studies in seed production, plant nutrition, and floriculture.

NURSERY WORK.—The nursery devoted to the propagation and culture of fruit trees for the variety orchard collection and the propagation and culture of ornamental trees and shrubs for planting about the grounds has been enlarged. During the winter about 4,000 apple grafts and 18,000 privet cuttings were prepared and are now growing in the nursery. There are also growing in this area about 5,000 ornamental shrubs, 8,200 ornamental trees, 5,150 fruit trees, 4,000 fruit-tree seedlings to be used for stocks for grafting purposes, 450 bush fruits, 1,000 seedling evergreens, and 1,840 herbaceous perennials.

GREENHOUSE WORK.—The last two of the range of ten greenhouses at the farm have been erected during the year, and the entire range will be ready for occupancy at planting time this fall. During the past year about 2,000 roses, 5,000 carnations, 4,000 bedding plants, and 4,000 shrubs were propagated in the greenhouses. Many annual flowering and vegetable plants for the variety tests and other gardens were also started in the houses and later transplanted to the open. The study of blind versus flowering wood rose cuttings is being

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continued, as mentioned in the previous report. The plant-nutrition studies are also being continued in somewhat increased areas. Considerable attention has been given to the improvement of forcing-house crops by seed selection. About 4½ pounds of lettuce seed, 3 pounds of cauliflower seed, and 1¾ pounds of tomato seed from specially selected forcing-type plants have been obtained during the year.

HORTICULTURAL INVESTIGATIONS.

The special work on horticultural crops has been continued during the year and good progress has been made along a number of lines.

IRISH-POTATO INVESTIGATIONS.—The work with Irish potatoes has been strengthened and increased by engaging the services of Prof. William Stuart, Expert. Since the potato is one of the most important of American crops, the work which has already been commenced should be rapidly extended. Studies of disease resistance of potatoes, which have been under way for several years, have been continued in cooperation with the Vermont Agricultural Experiment Station. A number of the more promising disease-resistant varieties of European and American origin were grown at St. Albans, Vt., on a scale sufficient to supply seed tubers for distribution purposes. These varieties were sent out during the spring of 1910 to growers in Minnesota, Wisconsin, Michigan, Ohio, New York, Pennsylvania, Virginia, and West Virginia for the purpose of testing their adaptability and disease-resistant qualities over a much wider area than has been heretofore possible.

The California potato investigations heretofore carried on by the Office of Cotton and Truck Disease Investigations have been largely transferred to this office. Professor Stuart spent two months in California the past spring in conducting experimental investigations of the scab disinfection of seed potatoes by the formaldehyde gas treatment and in planting variety trials and fertilizer tests in the great potato fields of the Sacramento River region.

PEANUT INVESTIGATIONS.—During the past year great progress has been made in the use of the peanut as a unit in the crop-rotation system of the boll-weevil districts of Texas and Louisiana. Experiments in the manufacture of peanut oil have been carried to a point which leaves no doubt that peanut oil is a commercial possibility in this country. The market demand for peanuts and the status of the crop are such as to warrant a great and profitable increase in the acreage in this country, and until this demand is satisfied there is little hope of developing the peanut-oil industry.

The experiments with Spanish peanuts conducted in Louisiana and Texas last season gave very satisfactory results, demonstrating that on the sandy soils of the boll-weevil districts peanuts are generally now more profitable than cotton. In the older peanut district of Virginia and North Carolina demonstrations in crop rotation and the maintenance of soil fertility have been begun.

During the past year cooperative seed selection has been continued with certain growers of peanuts. A certain grower during the present season planted 53 acres with selected seed from plants of highly productive qualities, and he is rapidly establishing a reputation for high-grade seed peanuts.

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ONION INVESTIGATIONS.—During the past year seed of the Denia onion has been distributed to some twenty localities in the southwestern part of the United States. Although it is yet too early to publish results from any of these experiments, the results of last year's trials, together with those achieved at the New Mexico Agricultural Experiment Station with seed imported by the Department of Agriculture and from other sources, justify further work on this crop.

CELERY INVESTIGATIONS.—The methods of culture practiced by the celery growers in the vicinity of both Stockton and Los Angeles, Cal., were studied during the season. The workings of cooperative marketing as carried on by the California Vegetable Union were also investigated. A representative of the Department also visited the Florida celery region during the harvesting season and investigated the causes of the late harvest, as well as the cultural practices followed in bringing this crop forward for market.

SWEET-POTATO INVESTIGATIONS.—A study of the varieties of sweet potatoes has been continued. The variety collection has been maintained and plants of leading market sorts have been distributed for trial in new localities. An investigation of some of the troubles of sweet potatoes while in storage has been undertaken in cooperation with another office of the Bureau of Plant Industry. The investigation of the value of desiccated sweet potatoes as stock food has been continued. Samples aggregating several hundred pounds have been dried, these being sufficient to demonstrate the practicability of the process. Analyses of the dried product indicate a high value as stock food.

VEGETABLE TESTING.—The study of varietal differences in garden vegetables and their practical importance has been continued under the immediate charge of Dr. W. W. Tracy, and material progress has been made, not only in our knowledge of such differences but in directing attention to their importance. A number of the largest packers and canners have appealed to the Department for suggestions and advice as to the best varietal type for their particular purpose and how best to obtain seed which will uniformly develop into plants of that type. This study has made it clear that in some instances superior varieties have been ignored by seedsmen, so that it is very difficult to obtain seed in commercial quantity, because seed of such varieties can not be as profitably grown and handled at the same price as that of some of the more common sorts.

The importance of uniformity of stock and the practical possibility of effecting a great improvement in this respect by wisely directed line breeding have been studied and material improvement in methods has been developed. The work of preparing a set of bulletins on the growing of superior strains of vegetable seeds has been continued, and a publication on growing the seed of sweet corn, peas, and beans has been issued, while others on growing seed of cruciferous and cucurbitaceous plants are in preparation.

FERTILIZER EXPERIMENTS WITH TRUCK CROPS.—The fertilizer experiments inaugurated at Norfolk, Va., and in the Long Island area have been continued, and a very important observation has grown out of this work, namely, the value of potash in the form of sulphate as

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a fertilizer for potatoes in both of these regions. The crop production, as well as the quality of the potatoes produced, is far superior in every combination of fertilizer where sulphate is used over any other form of potash. The difference in crop yields indicated in our tests, if carried out in commercial practice, will many times over repay the cost of the experiments.

TRUCK-CROP SURVEY.—The truck-crop survey has been continued during the year and important additions have been made to this study, which we hope will ultimately make it possible to determine with considerable accuracy the dates of planting, time of harvest, and market possibilities open to each region or crop zone during the period at which it can normally supply the demand. This result, if attained, will have a tendency to adjust the crop planting to market requirements, thus obviating overproduction and depressed prices.

SCHOOL GARDENS.—The distribution of special collections of seeds for school-garden purposes has been continued on a very much larger scale during the past year than during any previous period. It has been possible to supplement the distribution by an additional collection of economic seeds, including the cereals, several important forage crops, fiber plants, and peanuts. The great demand for material for illustrating economic geography led to the assembling of this collection, which contains the 18 economic plants of greatest commercial value in sufficient quantity to enable teachers to plant demonstration areas illustrating the habit of growth of the crop, as well as to afford seed for laboratory study.

In addition to the seed distribution, plans for a number of school grounds offering instruction in agriculture have been provided. It is believed that this work will accomplish much toward the development of a taste for beautifying home grounds as well as public places, a taste which has too long remained undeveloped in our American people. The educational value of a well-planned school ground is not less than that of the instruction in the schoolroom, for it teaches not only the pupils themselves, but every passer-by.

PLANS FOR FUTURE WORK.

During the ensuing year the work on the farm at Arlington, as well as the special horticultural investigations, will be continued along the same general lines as heretofore.

ARLINGTON EXPERIMENTAL FARM.—The general policy now in force in the management of the Arlington Experimental Farm will be continued. The farm has, however, outgrown its present equipment, and there is great need for additional buildings, particularly for the scientific corps of the Department, who are interested in field experiments and who require laboratory facilities at the farm. The evolution of the work of the farm has clearly demonstrated its value and the necessity of providing suitable laboratory buildings which will enable the investigators to be in constant touch with their field experiments.

FLORICULTURAL INVESTIGATIONS.—A great need exists for a series of investigations of the floricultural interests of the United States. This work is so scattered that individual States, as a rule, are not

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justified in devoting a great amount of time and attention to it, yet the aggregate value of the industry is sufficient to warrant a thorough study of it. It is hoped that work of this kind can be undertaken in the near future.

POMOLOGICAL COLLECTIONS.

The Pomological Collections, including the identification of fruit varieties and the revision of the nomenclature of fruits, have continued in charge of Col. G. B. Brackett, Pomologist. About 300 herbarium specimens of fruit varieties have been added to the collections, which will be of value in the identification and description of varieties by foliage and flowers.

SIMPLIFICATION OF FRUIT NOMENCLATURE.—Investigations in this direction have been considerably retarded through the death of Prof. W. H. Ragan, so long in direct charge of the work; but considerable progress has been made during the past few months. The manuscript of a bulletin on peach nomenclature, following the lines of those previously issued on the apple and other fruits, is nearing completion. Much valuable material has been collected in connection with this work.

IDENTIFICATION OF FRUITS.—The number of fruits received for identification and description has exceeded that for several previous years. Of a total of 3,224 varieties received, 1,323 were for identification and 1,901 for comparison and examination. The new varieties of fruits received numbered 216. Descriptions of 524 varieties were obtained for the reference files of the office, and 453 water-color paintings, 28 models of new and rare fruits, and 14 drawings, charts, and lantern slides were obtained.

VARIETAL STUDIES OF FRUITS ON THE FARM AT ARLINGTON.—About 1,500 varieties of fruits are under experimental observation in cooperation with the Arlington Experimental Farm, and the heavy crop of the present season has made it possible to secure valuable notes, especially on peaches, that will be of interest to fruit growers. Seeds, scions, and plants of 11 species of fruits, representing 137 different varieties, were received during the past year and placed on trial on the Arlington Experimental Farm. Varieties were also sent for trial to several of the state experiment stations and to cooperators in various sections.

FIELD INVESTIGATIONS IN POMOLOGY.

The field work of the Bureau with reference to the culture and handling of fruits has continued along the same general lines as heretofore, under the direction, until February 1, 1910, of Mr. Wm. A. Taylor, Pomologist, and of Mr. G. Harold Powell. Upon the appointment on that date of Mr. Powell as Pomologist and Assistant Chief of Bureau, Mr. A. V. Stubenrauch, Expert, assumed general charge of the fruit transportation and storage investigations. Good progress has been made in the various lines of investigation during the past year.

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FRUIT-MARKETING INVESTIGATIONS.

The fruit-marketing work of the year has been continued under the general direction of Mr. Taylor, assisted by various members of the field staff.

EXPERIMENTS WITH PERSIMMONS.—Experimentation with the ripening of Japanese persimmons with a view to developing practical methods of removing their astringence in advance of the softening of the fruit, an end which appears essential to the further development of the persimmon industry, has been continued.

UTILIZATION OF SURPLUS FRUITS.—Experiments on the drying of pineapples and utilizing surplus ripe fruit of this plant in other ways during periods of glut and low prices have been made, and indicate a strong probability that such surplus, which would otherwise be wasted, can be converted into wholesome and desirable food products. Experiments in the storing of unfermented apple juice at low temperatures indicate that this product by proper methods of handling can be held in ordinary apple storage rooms in sound and wholesome condition for several weeks without sterilization by heat or the addition of preservatives. The technical features of all of the work looking toward the utilization of surplus fruits have been handled by Mr. H. C. Gore, Scientific Assistant, in cooperation with the Bureau of Chemistry.

FRUIT TRANSPORTATION AND STORAGE INVESTIGATIONS.

The work on fruit transportation and storage has continued along the lines of previous years and valuable results have been secured. Messrs. Powell and Stubenrauch have been assisted in various phases of the work by Messrs. L. S. Tenny, Pomologist; S. J. Dennis, H. J. Ramsey, C. S. Pomeroy, and A. W. McKay, Experts; C. W. Mann, H. M. White, and B. B. Pratt, Scientific Assistants; and C. F. Galligan, Special Agent.

TABLE-GRAPE TRANSPORTATION.—Investigations in the marketing of table grapes, begun at Lodi, Cal., during the season of 1908, were continued during the past shipping season. The results of this year amply corroborate those obtained the previous year. This work has for its object the determination of the factors which govern the keeping qualities of table grapes in transit, and the investigation of the relation of handling the fruit in preparing it for shipment to the occurrence of decay in transit. The work consisted of the shipment of a number of experimental series picked, packed, and handled under exact conditions. In all 33 shipments were made to New York, where they were carefully inspected, the percentages of decay and deterioration being determined by weight. Each shipment consisted of fruit picked and packed under ordinary commercial conditions and fruit carefully picked and packed both in crates and in boxes with fillers of ground cork and redwood sawdust. In loading in the cars, portions of each kind of fruit and type of packing were placed on the floor or bottom tier and on the top tier of the load. The fruit was held a week after arrival, and inspections were made on the day of arrival and on the third, fifth, and seventh days thereafter.

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There was a most striking difference between the commercially packed and the carefully handled series, both on arrival and during the holding test. The average decay in the commercial packages on arrival was 5.8 per cent, while the carefully packed fruit showed 1.2 per cent of decay. This difference was maintained through the holding test. After seven days the commercial packages showed 20.2 per cent of decay, while the carefully packed fruit increased in decay only to 9.9 per cent. In the appearance of the fruit, the differences were even more marked in favor of the carefully handled lots. The fruit packed in cork had 1.5 per cent of decay on arrival, and after seven days 5.7 per cent. The redwood sawdust packages had 0.3 per cent and 1.2 per cent of decay, respectively, on arrival and seven days thereafter. The change from crate packing to sawdust packing is not to be recommended, however, for ordinary commercial shipments, except as a last extremity. The trade is accustomed to receive California grapes packed in crates, and would undoubtedly object to a change in the method of packing unless absolutely necessary to insure the sound condition of the fruit. The results of the investigations show that by using care to eliminate injury in picking, handling, and packing grapes can be transported in crates with little or no decay.

Another important feature of the results of the grape-shipping work is shown by the comparison of fruit loaded on the bottom and top tiers of the car. On arrival the decay on the top tier averages nearly twice that found on the bottom. This difference militates more strongly against the commercially handled than against the carefully handled packages. The commercial packages showed an average of 4 per cent of decay on the bottom tier and 7.5 per cent on the top, while the carefully handled packages had 0.9 per cent of decay on the bottom and 1.6 per cent on the top. The work shows a direct relation between the method and type of handling and decay.

Along with the shipping and handling experiments, a series of local demonstrations were made by holding duplicate lots in a refrigerator car kept iced during the season. These series were withdrawn on the days when the corresponding ones reached their destination. The lots were placed on exhibition and the growers and packers were invited to witness the demonstration. The work has received the hearty cooperation of all concerned with the industry—growers, shippers, transportation companies, and eastern receivers—and a marked improvement in the methods of handling and shipping has resulted.

TABLE-GRAPE STORAGE.—Investigations consisting mainly of the study and determination of the factors which govern the keeping qualities of table grapes in cold storage, with a view to lengthening the marketing season, were continued during the year. The production of grapes in California is increasing rapidly and the prospects are that the output will be more than doubled when new plantings come into bearing. Thirty-five new varieties grown on the cooperative experimental vineyards of the Department in California were included in the tests of the past season.

The most important result of the work brought out and fully corroborated is the fact that the storage period of holding grapes can be very materially lengthened by packing with some filling material; in fact, it is not feasible to hold this fruit any great length of time when packed in the ordinary shipping crate without a

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filler. The conclusion of former years that redwood sawdust is superior to ground cork for holding grapes in storage has been fully confirmed. The use of the sawdust both in shipping and storage investigations on a rather extended scale shows that it will have to be subjected to a sifting or fanning process to remove the fine dust particles and slivers. These fine particles cling tenaciously to the grape berries, especially at the pedicels, and spoil the appearance of the fruit on the market. It is evident that unless some way can be found to avoid this the use of sawdust can not be adopted on a commercial scale.

The continuation of these investigations is planned for the coming season. The storage experiments will be made on a larger scale and the effect of prompt and rapid cooling will be very carefully studied. It has been shown that under the best conditions the cooling of the grapes packed in sawdust will be relatively slow, owing to the insulating effect of the packing material. It is planned next season to overcome this disadvantage by cooling before packing. Additional work will be done at Fresno and Lodi, and a number of shipments will be made for storage after arrival in the East.

LEMON HANDLING AND SHIPPING.—The investigation of the methods of handling upon the keeping quality of California lemons was continued on a broader scale, and the work was extended to include a series of shipping experiments, with a view to showing the effect of careful grading and packing upon the carrying qualities of the fruit in transit. The two lines of work were carried on simultaneously. The field-handling investigations were done on a larger scale, and districts and houses were selected for this work which had not been included in former years. Forty-six experiments were made in fifteen packing houses, the work consisting of a comparison of carefully picked and handled fruit with the same fruit picked and handled under ordinary commercial packing-house conditions. The effect of washing was also studied.

Analysis of the results of the experiments shows that the condition and maturity of the fruit materially influence the amount of injury in handling and consequent decay. Green lemons are the strongest, while those which are allowed to color or ripen on the tree are the weakest. Lemons are picked to size, and the most desirable are those which reach full size while green. Regular and systematic picking is necessary to reduce the proportion of the weaker tree-ripe fruit to a minimum.

The shipping investigations included a comparison of fruit, carefully graded and packed, with the same fruit graded and packed under ordinary packing-house methods. The work was done on as large a scale as possible in order to represent commercial shipping conditions. Forty-five shipments, consisting of 178 boxes, were sent through to Washington, D. C. Inspections were made on the day of arrival and one, two, and three weeks thereafter, the fruit being held under ordinary open-market conditions. Represented in the experiments were shipments from houses where the handling was as carefully done as that done under the immediate supervision of the government investigators. The ordinary packages of these houses showed less decay than the average of all the carefully handled shipments, while the shipments from houses where the handling was done less carefully showed much heavier decay.

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The work has met with very hearty cooperation. Nearly all of the fruit used in the experiments was supplied without charge to the Department. The investigations have resulted in a marked improvement in the handling of lemons. The work has been both demonstrational and investigational. As definite results were obtained they were quickly communicated to the growers and packers. At the close of the work a series of meetings was held in different packing houses, and the results were presented by means of charts and tables and all phases of the work were fully explained and discussed. These meetings were well attended, as many as 200 growers attending one session, and great interest was manifested.

LEMON STORAGE.—Investigations in lemon storage were continued on a small scale during the past year, mainly with the object of corroborating some of the results of previous seasons. The effect of different storage temperatures was again studied. Both fresh and cured fruit was held at 32°, 37°, and a temperature approximating 40° F., as compared with common cellar-storage conditions. The 40° temperature gave much the best results, but as the temperature of the storage room fluctuated considerably, further work at this temperature is advisable. The lemons kept best under cellar conditions, but shrinkage due to drying out was greater than is desirable. It is planned to continue these investigations through the coming season, using 40° F. as a minimum and again comparing this and one or two intermediate temperatures with the cellar-storage conditions.

FLORIDA CITRUS FRUITS.—Investigations were continued during the season of 1909–10 relative to the handling of Florida citrus fruits, and it was planned to carry on the work on a broader scale. Owing to unfavorable weather conditions, however, in December, 1909, and January, 1910, the progress of the work was seriously hampered. The work was carried out along lines similar to those of former seasons, including the study of the effect of handling upon the occurrence of blue-mold decay and of the effect of washing the fruit. Some shipping work was done, but much less than was planned, owing to the unfavorable weather conditions.

Field investigations were made a feature of the season's work. In several districts the Bureau workers made careful inspections of the work of picking gangs and packing houses, pointing out the amount of injury due to careless work and the effect of such injuries. As a result of these demonstrations and instructions the work done by picking gangs showed material improvement during the season.

The results of the washing experiments show considerable variation, depending upon the character of the work. In some sections only slight decay resulted from the washing of fruit, while in others where the work was carelessly done a material loss from decay followed. Where the machinery was operated at high speed, or where the wash water was not changed often enough to insure cleanliness, decay was always materially increased. An appreciable percentage of long stems in the fruit to be washed always resulted in increased decay. A summary of all the data obtained shows that washing increases the chance for decay, and should only be resorted to when absolutely necessary to place the fruit in marketable condition. When fruit must be washed the work should be done with the greatest care, both in the handling and the operation of the machinery and in using clean water.

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The shipping experiments consisted of the forwarding of a series of boxes to Washington, each series containing carefully handled and selected fruits packed very carefully under the supervision of the Bureau workers, and the same fruit picked, handled, and packed under ordinary commercial packing-house conditions. The effect of delay in packing and shipping was investigated. Inspections were made on the day of arrival at Washington and one, two, and three weeks thereafter, the fruit being held under ordinary market conditions. While the data obtained this season are rather meager, they are consistent and clean-cut, and show (1) that the least decay follows immediate packing and shipping; (2) that there is least decay in carefully handled and packed fruit and most in injured fruit; and (3) that less decay follows delay in packing carefully picked and handled fruit than in packing commercially handled or injured fruit.

The Bureau investigations have had a strong influence on the citrus industry in Florida. Improvement in the methods of handling is following the work in all sections of the State. Business and marketing methods have been changed to raise the standard. During the past year the Florida Citrus Exchange was organized and improvement in the marketing system and distribution of the crop has followed. Many new and up-to-date packing houses have been built and more are projected. The Bureau investigations should be continued at least through another season. Further demonstration work is necessary, and the shipping and washing experiments should be continued on a broader and more comprehensive scale.

CALIFORNIA APPLE STORAGE.—When investigations in apple storage were begun five years ago in California some of the varieties of apples from the Pajaro Valley were found to be affected in cold storage by a peculiar premature browning of the flesh of the fruit. This trouble, which has been designated as "internal browning," is worst on the Yellow Newtown, one of the principal varieties produced in the valley. Nothing just like it has been observed in fruit from any other section of the United States. All efforts in connection with the Bureau apple cold-storage investigations in California have been directed toward finding the cause of the trouble and some method of avoiding or overcoming it. The relation of the character of the soil, of delayed storage, and of stage of maturity when picked have all been carefully studied, but without yielding definite results. Last year the effect of different storage temperatures was studied. Lots of apples of the three leading varieties, Yellow Bellflower, Yellow Newtown, and Red Pearmain, grown in the district were held at 32°, at 34° to 35°, and at 37° F. Inspections were made in December, January, March, and April. The behavior of the fruit after withdrawal from storage was determined by holding the different lots ten days at common market temperatures.

The results show a distinct relation between the storage temperatures and the occurrence of the internal browning. Much less browning was noted in the 33° to 35° F. room than in the 32°, and still less in the 37° room. The latter temperature was found to be too high for commercial storage, except for a short time, on account of rapid ripening and the development of a "waxy" appearance. The external appearance of all varieties was best in the lots held at

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32° F. At 37° F. a rather large percentage of the fruit developed decay at the core, especially during the latter part of the storage season. This trouble would offset any benefit to be obtained in avoiding the browning at 37° F. The browning increased rapidly in intensity after the fruit was withdrawn from storage. Commercial storage houses holding their rooms this season at a temperature near 35° F., as a result of the Bureau investigations, report far less trouble than they had formerly when using a temperature of 32° F.

The work will be continued during the coming season, in order to obtain corroborative data and to make a more careful study of the effect of handling. A temperature held uniformly at 34° to 35° F. appears to be the best for the Pajaro Valley fruit, and a complete investigation of the effect of this temperature will be made. Fruit from the other apple districts of California will also be included.

PRECOOLING OF GEORGIA PEACHES AND CALIFORNIA GRAPES.—The precooling work on Georgia peaches begun by Mr. G. Harold Powell in 1904 was continued. The portable experimental refrigerating plant of the Bureau was used in Georgia during the season. Fifteen carloads of fruit precooled at Fort Valley were forwarded to New York along with a number of nonprecooled carloads for comparison. In each car marked crates were placed both on the top and bottom tiers. Careful inspections, including determinations of decay, were made on the day the fruit arrived and after holding two days under open-market conditions. The results of this work show a marked effect upon the condition of the fruit upon arrival and after holding. The precooled fruit averaged 6 per cent of decay on the top tier and 5 per cent on the bottom tier, while the nonprecooled fruit averaged 17 per cent of decay on the top and 7.3 per cent on the bottom tier. After holding two days, the precooled fruit averaged 34.3 per cent of decay on the top and 24 per cent on the bottom, while the averages of decay for the nonprecooled fruit were 45.6 per cent and 31 per cent on the top and bottom tiers, respectively. The lessening of the differences between the top and bottom tiers when the fruit is precooled is consistent and in line with the results obtained with other fruits. The results of this work are especially gratifying in view of the fact that it was not possible to operate the plant to best advantage. The water supply was somewhat deficient, and it was therefore impracticable to cool to as low a degree as would be desirable under commercial conditions.

Whether precooling in cars after loading is advisable or whether a system of cooling in refrigerated rooms before loading is preferable is still an open question. It is planned to continue the work in Georgia next season, with special reference to these points, and also to study closely the relation of careful handling to decay in transit.

At Lodi, Cal., eleven cars of grapes were precooled in connection with the handling and shipping investigations in August and September, 1909. The temperature of the fruit in these cars was reduced an average of 20° F. in about eight hours, by forcing 6,000 cubic feet of air at a temperature ranging from 34° to 35° F. through the cars each minute. The results of this work are indeterminate, and further necessary work along this line is planned for the coming season.

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VITICULTURAL INVESTIGATIONS.

The investigations of the culture and utilization of the grape have continued in charge of Mr. George C. Husmann, Pomologist, and good progress has been made. Mr. Husmann has been assisted by Messrs. Charles Dearing, Scientific Assistant; F. L. Husmann, Viticultural Superintendent; and J. E. Buck and Richard Schmidt, Special Agents.

PACIFIC COAST INVESTIGATIONS.—In the nursery of the Oakville, Cal., experimental vineyard 47 new introductions of grape varieties received through the Office of Foreign Seed and Plant Introduction, together with 64 additional Vinifera varieties and 123 resistant-stock varieties from other sources, are being grown for future use. As all of the resistant-stock varieties under test are growing in the Fresno and Oakville experimental vineyards and an early determination of their relative resistance is important, phylloxera have been artificially placed upon their roots to insure a uniform distribution of the insect. These "inoculations" were made in cooperation with the Bureau of Entomology.

Additional plantings have been made of 84 grape varieties in the Chico vineyard, 76 in the vineyard at Colfax, 9 at Cucamonga, 61 at Lodi, and 99 at Oakville to ascertain the relative congeniality of Vinifera varieties to resistant stocks; the value and behavior of varieties with reference to soil types, climatic, and other conditions; and the relative value of particular Viniferas not heretofore grown in the United States. Along these lines valuable results and important conclusions are being secured from the older plantings in the experimental vineyards. Cuttings of Vinifera and resistant varieties have been sent to cooperators in various sections.

ROTUNDIFOLIA INVESTIGATIONS.—In the work on Rotundifolia grapes 1,152 seedlings have been transplanted from the Arlington Experimental Farm of this Bureau to the Pender farm of the North Carolina Department of Agriculture, at Willard, N. C. Of those that have blossomed about one-third are pistillate vines. The other Rotundifolia plantings are thriving and the vines are being trained to various systems on specially constructed trellises. Observations on pruning experiments at Ronnoc Grove, near New Smyrna, Fla., at the Medoc vineyards, near Enfield, N. C., and at other points were continued and previous results were corroporated. In cooperation with the Bureau of Chemistry, experiments in making unfermented grape juice from Rotundifolia varieties were continued and much valuable data were obtained. Further research along this line is necessary and is projected.

GRAPE INVESTIGATIONS IN NEW JERSEY.—The grape pruning and training experiments on the farm of the Training School for the Feeble-Minded, at Vineland, N. J., have been continued. The results are showing that Concord grapes can be successfully grown in that section. The restoration of old, run-down vines to full bearing and vigor by proper training methods and care is also being fully demonstrated. These investigations have given new life to the industry of this and other sections, and as a result a considerable acreage of new vineyards has been planted.

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FRUIT-DISTRICT INVESTIGATIONS.

The projects included in the general title of fruit-district investigations have continued in charge of Mr. H. P. Gould, Pomologist, assisted by Mr. W. F. Fletcher, Scientific Assistant.

ADAPTABILITY OF FRUIT VARIETIES TO ENVIRONMENT.—The study of the adaptability of fruit varieties to different conditions and, conversely, of the influence of conditions on the behavior of varieties forms the leading feature of these investigations. Field work in the Ozark Mountain region has been practically completed, and the data obtained in the several seasons during which it has been in progress are being prepared for publication. Great orchard interests, especially in apples and peaches, have developed in this region, and in some respects the present period may be considered a critical one for these interests. In many places smaller orchards, more intensive methods of culture, improved methods of handling the fruit, and greater diversification in the agricultural interests of the region (in which some form of stock raising, especially dairying, constitutes a prominent part) will be found more profitable than the present system of orchard management.

Investigations of a similar character were begun in the region of Oklahoma lying between the Ozark formation and the semiarid or Great Plains region. This work was considerably extended last season in Oklahoma, Kansas, and southeastern Nebraska. The possibilities of fruit growing for home use in the central and southern Great Plains regions have also received attention. The conditions there are severe and fruit growing will probably not assume a commercial status, except in rare instances, but the importance of the family orchard in home building warrants consideration. During many seasons some fruit may be grown. Cherries and some varieties of the native plums are the most promising fruits, but certain varieties of apples are also to be recommended.

COOPERATIVE AND OTHER WORK ON FRUIT VARIETIES.—The dry-land fruit garden, located at the substation of the Bureau at Akron, Colo., is making good progress and now contains 5 kinds of orchard fruits and 8 or 10 kinds of small fruits representing many different varieties. While definite conclusions can not be reached regarding the relative adaptability of the varieties under observation until they have been tested for a longer time, there are some rather marked differences in the growth of the trees and small fruits of different sorts.

In cooperation with the Forest Service, preliminary work is now in progress with reference to the growing of home fruits by the forest rangers in the national forests. Several thousand apple grafts have been propagated at the Arlington Experimental Farm for planting at ranger stations where they can be grown with a view to obtaining data on the adaptability of fruit varieties to a large region of country where little fruit is now cultivated, and under very diverse conditions.

Phenological studies of fruit culture have been continued along the same lines as in previous years, with a slight increase in the number of cooperative observers. A large quantity of data has been collected, covering a wide range of climatic conditions and forming an important source of reference, the value of which will be very greatly increased when compiled and correlated.

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MISCELLANEOUS POMOLOGICAL WORK.

The work on the adaptability of pecan varieties and also that with reference to the improvement of citrus fruits have made good progress during the past year.

PECAN INVESTIGATIONS.—Work having for its object the determination of the relative merit and cultural adaptability of pecan varieties to cultivation in the South Atlantic and Gulf States has been conducted by Mr. C. A. Reed, Special Agent, along lines followed in previous years. The work is growing in importance and extent, and a large quantity of data is being accumulated. Many inquiries from nut growers and prospective planters are answered through correspondence, as well as by addresses and consultation. Field experiments are being conducted to ascertain the importance of cross-pollination in pecan orchards, with special reference to the influence on the yield and quality of the crops. Cracking experiments with leading varieties were made during the past year to determine the comparative merits of the nuts of different varieties.

CITRUS-FRUIT IMPROVEMENT THROUGH BUD SELECTIONS.—Investigations now being prosecuted by Mr. A. D. Shamel, Physiologist, have for their object the improvement of citrus fruits, especially oranges, lemons, and pomelos, by bud selection. Previous observations in connection with the fruit transportation and storage work of the Bureau in California have indicated that there is great variability in yield, quality, and value of product of individual trees of the important commercial varieties and strains of citrus fruits. During the past year careful records were made of the yield of selected individual trees, and also of selected blocks of trees in typical groves. Records of the crop of each tree and the number of each size of fruit were carefully made, together with observations on the habit, vigor, type of growth, and quality of the fruit. In this way records were made of 207 orange trees and 75 pomelo trees, all 12 years old. The results show marked differences in the yields of trees growing under the same conditions. The yields of oranges in the same grove ranged from 14 fruits weighing 7 pounds to 816 fruits weighing 432 pounds per tree. The yields of pomelos ranged from 5 to 520 pounds to the tree, with fruits ranging from perfectly seedless to an average of 50 seeds per fruit. These records must be continued through a series of years, in order to determine whether the differences in yield persist.

GREENHOUSES, GARDENS, AND GROUNDS.

GENERAL MAINTENANCE AND OPERATION.

The work of caring for the greenhouses, gardens, and grounds of the Department has been continued by Mr. E. M. Byrnes, Assistant in Charge.

GREENHOUSE OPERATIONS.—In the Department range 26 greenhouses are now devoted to general propagation, hybridization, and plant-breeding work; to experimental work with vegetables and with florists' crops; to seed-testing work; and to various other lines of investigation of the Bureau of Plant Industry. The propagation of plants, both for distribution and for the ornamentation of the Depart-

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ment grounds, is a part of this greenhouse work. The experimental work with florists' crops included the growing of 1,702 roses, in 6 varieties; 5,615 carnations, in 8 commercial varieties and 728 seedling plants resulting from crosses made during the past winter; and 3,200 chrysanthemums, in 322 varieties and 428 seedling plants, which are the result of crosses made last autumn. The chrysanthemums were grown for the annual exhibition, which was opened to the public on October 27 and closed on November 3, 1909. Great interest in these exhibitions is shown by the public both inside and outside of Washington. At the close of the exhibition the flowers were cut and distributed to all of the hospitals in Washington.

CONSTRUCTION AND REPAIR OF GREENHOUSES.—To take the place of the old range of greenhouses which formerly stood at the south end of the Department grounds, 8 new greenhouses have been erected at the northeast corner of the grounds at a total cost of $8,728.16, or an average cost per house of $1,091.02. Seven of these houses, including a quarantine greenhouse, are 100 feet long, 20 feet wide, and 14 feet high; while one house, designed for pathological work, is 50 feet long, 20 feet wide, and 25 feet high. Facing the north end of these houses a frame shed on brick foundation, 120 feet long, 16 feet wide, and 16 feet high, was constructed for a storage and workroom, at a cost of $1,330.80. A similar shed was also erected facing the north end of a range of greenhouses in the northwest section of the Department grounds, being 155 feet long, 16 feet wide, and 16 feet high, and costing $1,765. This shed is being used for storage and workrooms and also for protecting the steam pipes carrying heat to the greenhouses. In the northeast corner of the grounds a fumigating house, 18 feet long, 16 feet wide, and 13 feet high, was constructed at a cost of $230.

Such repairs were made to the older range of greenhouses as were necessary to keep them in first-class condition. Eleven greenhouses were given a coat of paint, inside and outside, at a cost of $600. The old range of greenhouses on the north front of the west wing of the new Department building were torn down and removed.

GENERAL IMPROVEMENTS IN THE GROUNDS.—The ground on the site of the old range of greenhouses which were removed was graded and sown in grass. A galvanized-iron pipe railing was constructed at the west end of the main Department building. In the Department grounds 882 square yards of cement pavements were laid and 705 square yards of asphalt roads and walks were resurfaced; worn portions of the macadam road were repaired and all of the macadam roads were sprinkled with waste sulphite liquor and an oil emulsion for the purpose of laying the dust and binding the surface so as to preserve it. A portion of the lawns was treated with 540 cubic yards of thoroughly decomposed stable manure. During the season the lawns were mowed and the edges trimmed as often as required to maintain them in good condition, the bare spaces being spaded and reseeded. The asphalt roads and walks were cleaned and swept daily, and the macadam roads were watered daily during the dry weather, previous to applying the waste sulphite. During the year 1,291 feet of galvanized-iron water pipe and 839 feet of sewer pipe were laid in the grounds.

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ORNAMENTAL PLANTINGS.—A collection of 12,500 standard sorts of crocus, hyacinth, tulip, and narcissus bulbs and 3,500 pansy plants were planted in the beds in the autumn for display in the early spring. A collection of 16,270 bedding plants in 38 species and varieties and 834 tropical plants in 29 species and varieties were planted in beds in the spring. On the trial grounds a collection of hybrid grasses and cowpeas was planted for testing. The collection of ornamentals in the grounds was increased by the planting of 17 young evergreen trees and 124 young flowering shrubs; and 11 young evergreen trees were planted at the east end of the new heating plant to form a screen. The shrubs and hedges were pruned as often as required, and dead trees and branches were removed from the grounds.

HYBRIDIZATION AND PROPAGATION OF PLANTS.

Mr. George W. Oliver, Expert, has continued his work in the hybridization and propagation of forage crops and other plants.

PRODUCTION OF HYBRID ALFALFAS AND COWPEAS.—Numerous crosses have been made between the new types of cold and drought resistant yellow-flowered alfalfas sent by Prof. N. E. Hansen from Siberia and the hardiest of the cultivated forms of *Medicago sativa* in the United States. Crosses have also been made between *Medicago glutinosa*, recently obtained by Mr. Frank N. Meyer in the Caucasus, and the Grimm and other alfalfas. All of the seed grown as a result of crossing which has been sown has produced hybrids. The method of crossing used with these minute flowers is described in Bulletin 167 of the Bureau of Plant Industry. It may be stated that as a result of two and one-half hours spent in manipulating the flowers in crossing, the number of seeds produced was 531, showing that the method of depending upon insect pollination for the production of hybrids is a fallacious one.

More than 900 new forms of the cowpea developed by crossing have been planted at the Arlington Experimental Farm. Two months after planting, a goodly number had ripe pods. Most of the plants now growing are of the third generation, while some promising lots are of the fourth and fifth generations. All of the standard varieties are being grown for comparison. A series of crosses between some of the standard varieties and what is evidently a very distinct variety from South Africa having very thick stems and branches are very promising.

PROPAGATION OF VARIETAL APPLE STOCKS.—The rapid propagation of varietal apple stocks whereby any variety may be grafted on its own roots has been the subject of investigation during the past year. It is generally conceded that seedling stocks are unreliable, no two of them being alike. It is now an easy matter to multiply stocks of any variety so that they may be used as the stock on which to graft the same or other varieties. A bulletin on the subject is now being prepared.

A bulletin dealing with some recent investigations on the rapid propagation of certain plants is now in the hands of the printer.

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FOREIGN SEED AND PLANT INTRODUCTION.

The work of bringing in from foreign countries new and valuable plants, which is, as heretofore, under the immediate direction of Mr. David Fairchild, Agricultural Explorer, has been materially strengthened during the past year by the appointment to the staff of Mr. P. H. Dorsett, Expert, who will have general charge of the various plant-introduction gardens, and of Messrs. Peter Bisset, H. F. Schultz, and Dr. Walter Van Fleet, Experts, who will have charge of definite phases of the work.

AGRICULTURAL EXPLORATIONS IN CENTRAL ASIA.—Mr. Frank N. Meyer, Agricultural Explorer, who left this country in August, 1909, to search for plants in the central Asian region, has been delayed by local conditions in reaching that territory, but he has secured many valuable seeds and plants from the Crimea, the Caucasus, and Bokhara. Among the most promising of these are a wild almond, which he suggests as a stock for stone fruits in our dry regions; the Afghasian apple and a special variety of pear which seem promising for trial in the Gulf States; the Erivan alfalfa, which is reported to be longer lived even than the Turkestan as tried in the Caucasus; a species of Medicago from an altitude of 4,000 feet, which seems to be new and has already been made use of in the work of creating new drought-resistant hybrid alfalfas for the Northwest; an olive from the Crimea which has withstood a temperature of zero and which fruits regularly; a collection of Caucasian cherries; the best Caucasian hazelnuts; a remarkable collection of table grapes which are much desired at the present time in California; the drought-resistant apple (*Malus pumila*) which is used in dwarfing the apple in Europe; a yellow-flowered peony which is something new in this class of flowers; a collection of sweet-kerneled apricots; the sand-binding plants which are used by the Trans-Caucasian Railroad; and a collection of winter wheats from the oases of Samarkand, Old Bokhara, and Merv.

AGRICULTURAL EXPLORATIONS IN PALESTINE.—The prolonged visit to this country which was made by Mr. Aaron Aaronsohn, of Palestine, during the formation of the Jewish Agricultural Experiment Station at Haifa, made it possible for the Department to secure the results of his long and valuable experience as an agriculturist in Palestine in the form of an important bulletin on the plants of that country which are likely to prove of value when introduced into America. A new dry-land stock for dwarf early pears in high arid situations has already been imported, as well as varieties of the chick-pea, a leguminous field crop which Mr. Aaronsohn believes is adapted to the dry-farming areas of the West; and his account of a wild relative of the cultivated wheat was considered of such importance that Mr. O. F. Cook, of this Bureau, was sent from Egypt, where he went on another mission, to investigate the possibilities of its acclimatization and use in this country.

WORK OF THE PLANT-INTRODUCTION GARDEN, CHICO, CAL.—The installation of an irrigation system and the erection of needed greenhouses have made it possible to propagate for distribution this year nearly twice as many introduced plants as were propagated at the Chico garden last year, and in addition a large amount of cooperative work has been carried on with various offices of the Bureau.

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The experiment of budding standard varieties of western peaches, prunes, apricots, plums, almonds, and cherries upon the newly introduced Chinese peach (*Amygdalus davidiana*), which is in common use in China as a stock for all kind of stone fruits, was so very satisfactory (with the exception of cherries) that it was thought advisable to plant a test orchard of 10 plants each of all of the varieties budded (cherries again excepted), in order to further determine the resistance of this stock to disease, drought, and other adverse climatic conditions, and also its congeniality to the varieties used. Plants of this new stock suffered less from the extreme cold during the past winter in Iowa than any of a number of other peach varieties tested, and in southwestern Texas and in the Colorado Desert of California grafted plants of it are doing remarkably well.

Considerable interest is being shown in the carob tree, or St. John's bread, the pods of which contain 40 per cent of sugar and 7 per cent of protein, promising to be of great commercial value as a stock food in sections where it can be successfully grown. Carob trees are growing well in California, from Chico southward, and also in southern Florida, showing comparatively little injury from a temperature of 18° F. last winter.

A rather small, sweet red cherry, introduced from central China and propagated for distribution at the Chico garden, ripened fruit in ten days to two weeks earlier than the earliest cherries cultivated in that section. Several of the introductions of the Chinese jujube (Zizyphus) have borne fruit and give evidence of being of commercial importance in the warmer portions of the semiarid Southwest. It is expected that several introductions of apricots, plums, peaches, and nectarines, previously propagated and planted at the garden, will fruit in the spring of 1911. A Chinese bramble (*Rubus rosaefolius*) gives promise of considerable importance, primarily from the fact that it ripened its fruit in April, at a time when standard varieties were just in bloom. The *Feijoa sellowiana*, a new fruit belonging to the guava family, originally introduced from Brazil, giving promise of commercial value, is now being investigated at the garden.

PLANT-INTRODUCTION GARDEN, BROWNSVILLE, TEX.—In the work of the past year at Brownsville in the testing of numerous forage plants and a wide collection of newly introduced fruits and other plants it has become evident that a thorough and efficient system of underdrainage will be necessary in order to prevent the accumulation of alkali in the upper strata of soil, and a comprehensive drainage system which will be of interest to the farmers of southern Texas will be installed during the coming year. Owing to this fact many of the plants which otherwise might be expected to do well at Brownsville have not been given a fair chance. Certain especially hardy forms, however, such as the bamboos, have been successful. As windbreaks form an important factor in the agriculture of this section of the country, the discovery of the use of the imported oriental bamboos as windbreaks is worthy of special mention.

PLANT-INTRODUCTION GARDEN, MIAMI, FLA.—The work of the Bureau in Florida has been reorganized and devoted to general field work throughout the State in promoting the cultivation and propa-

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gation of such promising new introductions as the avocado, mango, and other subtropical fruits, a special expert being appointed to devote all of his time to this work. As mentioned in the last report, under this reorganization the garden at Miami was turned over to the Subtropical Garden Association, to be operated by them under a cooperative agreement. Subsequent developments, however, showed the advisability of reconsidering this arrangement, with the result that at the beginning of the present fiscal year the Department again resumed full direction and control of the Miami garden work, placing an expert propagator in charge, who is familiar with the propagation of such subtropical fruits as the mango, avocado, and anona.

Plant-introduction garden, Ames, Iowa.—Satisfactory results are being obtained at the station at Ames, in cooperation with the Iowa Agricultural Experiment Station, in the propagation of introductions thought to be of value for the Great Plains region, where only the hardiest of such plant immigrants will grow and succeed. In addition to a collection of miscellaneous breeding material, there is being assembled at this garden a large collection of relatives of the plum, pear, apple, and peach for breeding and experimental purposes, in an endeavor to develop, if possible, races better adapted to the trying climatic conditions of the central Northwest. Already one new introduction, the wild Chinese peach, has proved hardier than even the Hills Chili, a standard heretofore of extreme hardiness.

Bamboo garden, Brooksville, Fla.—The generosity of a local tobacco company in deeding 20 acres of fertile hummock land at Brooksville, Fla., heavily timbered with trees indigenous to that section, to the Florida Agricultural Experiment Station, to be held in trust for the use of the Department of Agriculture, made the establishment of the bamboo garden possible. The soil, a sandy loam underlaid with clay, is naturally well drained. In view of the similarity of the conditions to those in countries where the bamboo is indigenous, it is believed that an ideal place for this work has been found. Ten acres of this land were cleared in 1909, five of which were planted in the spring of 1910 to four of the best timber varieties of bamboo. The work as planned has for its object the growing of the species of valuable bamboos in sufficient quantity to demonstrate their commercial importance in the United States. In addition to these plantings at Brooksville, one acre of young imported plants has been set out at Avery Island, La., in cooperation with a local company.

As bearing on the probable future of bamboo culture in this country, the report from Mr. Frank N. Meyer, Agricultural Explorer, of the successful establishment of a bamboo industry in the Caucasus, giving new methods of handling the canes in the manufacture of furniture, deserves mention.

Aroid root crops.—For several years past experiments in the growing of the edible aroid root crops, yautias, taros, and dasheens have been carried on in the Southern States. These plants, which are related to the ordinary caladium or elephant's ear, yield tubers that are adapted for table use, stock food, and the manufacture of starch and industrial alcohol. Their composition is similar to that of the ordinary white potato, and some varieties, when prepared for the table, can barely be distinguished from the potato. These crops have been grown as a staple article of food in tropical countries from

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prehistoric times, and people from temperate climates easily acquire the taste for these substitutes for the potato. In the fall and winter of 1909–10 tubers of the dasheen were distributed to a large number of persons in Washington, D. C., for testing as a table vegetable, and were well liked by nearly all who tried them. Some varieties are grown exclusively for their leaves, which form an excellent substitute for spinach. One of these was grown in the Canal Zone by the Commission's horticulturist for the tables of the American employees, and although hundreds of pounds were harvested daily during the season, the demand could not be supplied.

DEVELOPMENT OF THE MANGO INDUSTRY.—Very satisfactory progress has been made during the past year in mango research work in Florida, and the importance of this industry is becoming more fully realized. The common seedlings are being gradually worked over to improved East Indian varieties, as these realize better prices in the northern markets. The danger from frost naturally limits the cultivation of this fruit to certain favored sections of Florida and especially favorable locations in California. The successful demonstrations of several oil-burning orchard heaters in carrying tender plants through several degrees of frost will probably give mango culture a much wider range than was heretofore considered feasible.

Of the East Indian mango introductions tested under Florida conditions, 21 have already been fruited, eight new kinds maturing their first crops this year. Investigations in mango budding have been continued at the plant-introduction garden, Miami, Fla., with extremely satisfactory results, which show clearly the practicability of this method.

DEVELOPMENT OF THE AVOCADO INDUSTRY.—Avocado culture is attracting more than ordinary attention in Florida and southern California, and the commercial importance of this peculiar, nutty-flavored salad fruit is universally recognized. The brisk demand for avocados in the East at fancy prices has stimulated a lively interest in their cultivation and is causing an extension of the present groves and the planting of new ones.

A study of the peculiarly favorable conditions of the southern portion of the west coast of Florida appears to justify rather extensive plantings there, and plans have been made for a wide distribution of named sorts in that area. Particular attention has been given to the introduction of unusually early or late fruiting strains, as these prove most desirable from a commercial point of view, and a number of promising seedlings are under observation in cooperative orchards at Miami and Homestead, Fla. The fact that seedling groves do not produce crops of uniform fruit is becoming more fully recognized and the majority of planters are either top grafting their seedlings or planting budded trees.

FORAGE-CROP INVESTIGATIONS.

The investigations and demonstration work of the Bureau on forage crops have continued along essentially the same lines as heretofore, under the direction of Prof. C. V. Piper, Agrostologist. A large part of the work has been devoted to securing, testing, and distributing new forage crops, especially such as have promise for the semiarid regions and the Southern States where better forage crops are desired.

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ALFALFA EXPERIMENTS.—Further experimental study of the hardy varieties of alfalfa has given somewhat discordant results as to their relative hardiness. The Grimm variety, which has been most exploited, is, however, hardy enough to withstand all but the severest winters in North Dakota. Much progress has been made in encouraging the growing of seed of this variety, and by another year it is anticipated that the supply will equal the demand.

Hybrids have been made between ordinary alfalfas and two of the hardy yellow-flowered alfalfas found in Siberia by Prof. N. E. Hansen. Some of these are apparently superior to either of the parents in habit and vigor. They are all being tested for hardiness.

ALFALFA VERSUS CLOVER IN THE EAST.—The experimental and demonstrational work has shown beyond doubt that alfalfa can be successfully grown in the East wherever there is a deep, permeable subsoil. It succeeds best, however, on limestone soils or on clay loams which have been heavily limed. There is still much to be learned in regard to the relative value of alfalfa as compared with clover on the so-called "clover-sick" lands. Much of the interest in alfalfa in the East has been due to the inability of farmers longer to grow red clover. Alsike clover has been much employed as a substitute, and alfalfa to a less extent. In a limited number of experiments red clover sown under the same conditions found necessary for alfalfa has succeeded well. Numerous experiments are now under way to determine how far this method may be relied upon with red clover and how the results will compare with alfalfa sown under like conditions.

BREEDING IMPROVED TIMOTHIES.—Work has been started at the grass-breeding station organized in September, 1909, in cooperation with the Ohio Agricultural Experiment Station at New London, Ohio. More than 200 selections of timothy are now being grown at the station and many more will be put out this fall. This work is being carried forward as rapidly as possible in order that seed may be obtained at an early date for testing under normal field conditions.

PASTURE EXPERIMENTS.—Grazing experiments conducted at Blacksburg, Va., in cooperation with the Virginia Experiment Station are progressing very satisfactorily. While this work has not continued for a sufficient length of time to give definite results it has already thrown considerable light on the subject of practical pasture management. The investigations at Blacksburg are being augmented by cooperative experiments with farmers and by field investigations.

NEW GRASSES.—Among the numerous new grasses under test two deserve especial mention, Sudan grass and Rhodes grass. Sudan grass is much like Johnson grass in appearance but without running rootstocks, and therefore is easily controlled, as is timothy. Its yield in all the tests thus far conducted is fully equal to that of Johnson grass. Rhodes grass has given splendid results in Florida, southern Texas, and along the Gulf coast, yielding at least two, and sometimes four, cuttings in a season. The hay is fine in texture and quality. This grass promises much in the way of a commercial hay grass for the extreme South.

IMPROVED SORGHUMS.—The testing of the numerous varieties of sorghum has continued at Chillicothe, Tex., for five years and has resulted in developing improved strains of dwarf milo, blackhull

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kafir, red kafir, sumac and orange sorgos, and in introducing various new varieties, among them pink kafir, feterita, and red amber sorgo. Large quantities of seed have been distributed, principally through Members of Congress. A number of seed growers have been encouraged to specialize in the growing of one or more of these varieties, so as to insure permanent sources of supply for pure seed.

COWPEA INVESTIGATIONS.—The very large number of cowpeas obtained from many sources, together with numerous hybrids of the more valuable ones made by Mr. G. W. Oliver, Expert, has made possible an intensive study of this crop, which has cleared up many points about the origin of the varieties heretofore in doubt. Four of the new varieties are manifestly so superior to all others in certain respects that seed is being grown in quantity. It is believed that the results of the work will limit the commercial varieties to only five or six at most.

SOY-BEAN INVESTIGATIONS.—The work on the numerous varieties of soy beans imported from Asia has been continued both at the Arlington Experimental Farm and in cooperation with twelve of the state experiment stations. Interest in this crop is greater than ever before. Out of the 350 varieties under test about 20 have finally been selected whose records indicate them to be the best of each type represented. Several of them are being grown in quantity for general introduction.

LEGUMES RESISTANT TO ROOT-ROT.—The importance of legumes in rotations makes it exceedingly desirable to obtain if possible species or varieties of forage value that are resistant to Texas root-rot. Numerous species and varieties are being tested on root-rot infested land in the hope of finding some that are resistant or immune.

DRY-LAND FORAGE CROPS.—Work is being continued at Chillicothe, Tex., Chico, Cal., and Pullman, Wash., in the testing of various drought-resistant forage crops and methods of culture. Similar work is being conducted at most of the dry-land experimental farms in cooperation with the offices of Dry-Land Agriculture, Western Agricultural Extension, and Grain Investigations. In general the most satisfactory results are being obtained from annuals and from perennials in cultivated rows. The results demonstrate that alfalfa thus cultivated is a profitable crop, especially for seed, and indicate that the same is true for the more drought-resistant perennial grasses.

CONGRESSIONAL SEED DISTRIBUTION.

The Congressional distribution of seeds and plants during the past year included standard and selected varieties of vegetable, flower, cotton, tobacco, and lawn-grass seeds, bulbs, grapevines, strawberry plants, and hybrid citrus trees.

VEGETABLE AND FLOWER SEEDS.—The contract for packing, assembling, and mailing the vegetable and flower seeds was awarded to the Brown Bag-Filling Machine Co., of Fitchburg, Mass., the lowest bidder, at $1.10 per thousand packets. This contract was later modified to provide for delivering packeted seed in mail sacks direct from the seed warehouse in Washington, D. C., to the Union Station at an expense of one-half cent additional per thousand

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packets, thereby obviating the necessity for rehandling several million packets by the postal authorities at the Washington City post-office. The work of packeting, assembling, and mailing the vegetable and flower seeds was begun on October 1, 1909, and completed on April 23, 1910. The total output was 50,173,525 packets of vegetable seed and 9,819,315 packets of flower seed. The demand for vegetable and flower seeds this year was greater than ever before, the entire quantity provided for the distribution having been sent out.

TOBACCO, COTTON, AND GRASS SEEDS.—A total of 6,029 packets of selected tobacco seed were distributed to persons especially interested in obtaining the best types of standard varieties as well as new and improved varieties developed by the Bureau. Nearly 12,000 1-peck packages of cotton seed of improved Upland and wilt-resistant strains developed by the plant breeders of the Bureau were distributed. All of this seed was grown for the Department under the supervision of its specialists. Of lawn-grass seed 16,280 ½-pound packages were distributed, consisting of a mixture of Kentucky bluegrass, redtop, and white clover.

BULBS, PLANTS, AND CITRUS TREES.—Popular varieties of hyacinth, tulip, and narcissus bulbs were imported and distributed, a total of 10,760 boxes, each containing 20 bulbs, having been sent out. The distribution of grapevines involved 4,880 packages of 5 vines each, representing 27 different varieties; while 6,100 packages of strawberry plants, containing 15 plants each and representing 26 varieties, were also distributed. A total of 1,252 trees of the new hybrid oranges or citranges developed by the Bureau were sent to growers in sections of favorable climatic and soil conditions, the recipient of each agreeing to give proper care and to report results to the Department.

MISCELLANEOUS SEED DISTRIBUTION.—During the year 44,104 packets of vegetable seed and 22,330 packets of flower seed already found to be adapted were sent to Alaska, either for distribution through the experiment station at Sitka or upon direct requests received by the Department. Small quantities of vegetable and flower seeds of suitable kinds were also sent to various army posts and to individuals in the Canal Zone, Hawaii, and the Philippines.

PRODUCTION OF DUTCH BULBS IN AMERICA.—The work of propagating Dutch bulbs at the cooperative garden near Bellingham, Wash., was continued during the past year. A supply of assorted hyacinths, narcissuses, and tulips was obtained direct from Holland and sent to the propagating garden to serve as mother bulbs. The blossoms were unusually fine this spring and the bulbs are multiplying rapidly. If the bulbs can be kept free from disease and if the climatic conditions continue to be as favorable in the future as the records of the Weather Bureau show them to have been in the past, there is every reason to believe that Dutch bulbs can be grown and propagated successfully in the Puget Sound region. The bulblets and offsets are now 1 year old and will not be fully developed for three or four years, when it is hoped that they can be used for congressional distribution and that sufficient data will then have been collected with regard to their propagation and handling to warrant the Department

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in publishing the results of its work at Bellingham for the benefit of those who may wish to engage in the business of growing Dutch bulbs commercially.

SUGAR-BEET SEED GROWING AND DISTRIBUTION.—The commercial production of American-grown sugar-beet seed at Fairfield, Wash., by the breeding of pedigreed strains from individual analyzed mother beets has continued to receive attention. The tests at Fairfield indicate that sugar-beet seed of high quality can be produced commercially in the United States and thus render the sugar-beet growers in this country independent of European growers for their supply of seed. During the past year 1,230 pounds of American-grown sugar-beet seed were distributed by the Department to sugar-beet factories, cooperators, and growers. Comparative tests of varieties of sugar beets from European-grown seed were also continued in cooperation with state experiment stations, sugar-beet factories, and cooperative growers in different sections of the country.

PLANS FOR THE NEXT SEED DISTRIBUTION.—The seeds to be distributed the coming year will be practically the same in kind and quantity as last year, unless there should be a serious shortage in the seed crop and the price should advance sufficiently to make it necessary to reduce the quantity. Great care will be exercised to obtain only the best seeds the market affords, and all purchases will be made subject to rigid tests for purity and germination. Owing to the heavy demand for seed this spring and the depleted stocks of seed in warehouses, a larger percentage of the seed will be grown under contract than formerly.

In the distribution of Dutch bulbs each box, instead of 2 hyacinth, 8 narcissus, and 10 tulip bulbs, as formerly, will contain 10 tulip and 20 narcissus bulbs, thereby giving each recipient 30 bulbs instead of 20. Owing to the size and cost of hyacinth bulbs, it was deemed advisable to discontinue their distribution, which, however, will be resumed when the bulbs now being propagated and grown at the garden near Bellingham, Wash., reach commercial size and are fully matured.

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REPORT OF THE FORESTER.

U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., November 5, 1910.

SIR: I have the honor to transmit herewith a report of the work of the Forest Service for the fiscal year ended June 30, 1910, together with an outline of the plans for the work of the Service for the current fiscal year.

Respectfully, HENRY S. GRAVES,
Forester.

Hon. JAMES WILSON,
Secretary of Agriculture.

CLASSIFICATION OF EXPENDITURES.

The appropriation act for the Department of Agriculture for the fiscal year 1910 and other acts appropriated for the Forest Service the following sums:

For salaries[a]		$60,200.00
For general expenses		3,986,000.00
For improvement of the National Forests		600,000.00
Total for the Forest Service		4,646,200.00
Available for the work of the Forest Service, under other congressional appropriations for the Department of Agriculture:		
Appropriation for naval stores industry ($1,050.68 brought forward from fiscal year 1909, less $4.55 carried over to fiscal year 1911)	$1,046.13	
Appropriation for paper tests (allotted to Forest Service)	9,560.75	
Total		10,606.88
From other sources:		
Federal cooperation (expenditures reimbursed by other federal bureaus)	4,627.16	
Private cooperation ($28,674.35 contributed by cooperators in 1910; $19,291.25 brought forward from 1909; less $1,239.60 returned to contributors)	46,726.00	
Total		51,353.16
Total from all sources		4,708,160.04

At the close of the year there were unexpended balances as follows:

From appropriation, salaries and general expenses	$21,271.42	
From appropriation, improvement of the National Forests	1,164.36	
From appropriation, paper tests	1.68	
Unexpended cooperative funds	7,295.21	
Total		29,732.67
Amount expended		4,678,427.37

[a] In addition to this appropriation for salaries for specified positions, the appropriation for general expenses is available for salaries for the purposes set forth in the bill.

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The total expenditures for the work of the Forest Service were, therefore, $4,678,427.37. The objects of that work were to administer, protect, and improve the National Forests, and to promote the practice of forestry generally through cooperative and investigative work and through the diffusion of knowledge of the results of investigations. Prorating among the various lines of work such general expenses as the salaries of the Forester and Associate Forester, rental of quarters at Washington, etc., and grouping the cost of these various lines according to the object sought, the total expenditure may be subdivided as follows:

Administration and protection of the National Forests	$3,752,316.91
Permanent improvements, National Forests	598,835.64
Cooperative and investigative work and making known results	327,274.82
Total	4,678,427.37

There were also made under the direction of the Forest Service the following miscellaneous expenditures:

National Bison Range, Montana:		
Purchase of land	$29,896.48	
Construction of fence and sheds	17,494.74	
		$47,391.22
Refunds to depositors, excess deposits (34 Stat., 1270)		48,966.86
Payments to States and Territories, 25 per cent of receipts from National Forest resources for fiscal year 1909		438,702.81
Payments to Indians on account of timber receipts on former Uinta Indian lands (33 Stat., 1070)		1,113.47
Cooperative funds returned to contributors		1,239.60
Total		537,413.96

The following statement shows the amounts paid to States and Territories, to be expended for roads and schools, from the National Forest receipts of the fiscal year 1909, and the approximate amounts that will be paid from the receipts for the fiscal year 1910:

State or Territory.	Amount paid fiscal year 1909.	Amount payable fiscal year 1910.	State or Territory.	Amount paid fiscal year 1909.	Amount payable fiscal year 1910.
Arizona	$38,313.45	$51,229.38	New Mexico	$26,769.64	$28,529.53
Arkansas	1,586.74	2,904.44	North Dakota	None.	63.64
California	47,657.71	60,752.91	Oklahoma	584.84	626.10
Colorado	49,521.21	50,306.19	Oregon	33,120.47	39,635.87
Florida	None.	706.38	South Dakota	10,501.08	9,808.93
Idaho	48,892.79	66,074.55	Utah	33,293.40	32,905.49
Kansas	1,173.25	1,004.67	Washington	16,017.56	23,671.89
Minnesota	25.37	457.37	Wyoming	34,246.85	34,704.54
Montana	78,172.37	83,678.38			
Nebraska	2,837.34	2,820.25	Total	438,702.81	506,194.84
Nevada	15,988.74	16,314.33			

This shows an increase of $67,492.03, or a little over 15 per cent.

THE NATIONAL FORESTS.

AREA.

During the year the gross area of the National Forests—that is, the total area within the Forest boundaries, without deduction for alienations—suffered a net decrease in consequence of boundary changes which eliminated from the Forests 2,037,645 acres and added 453,517 acres. No new Forests were created. The boundary changes are the outcome of the field investigation reported as under

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way last year, but not all the changes called for by the data gathered have yet been made. Eventually they will probably result in the elimination of a total of some 6,250,000 acres and the addition of over 3,000,000 acres. In the States of Washington, Oregon, Idaho, Montana, Wyoming, and Colorado only eliminations are possible under the law, although the boundary examinations disclosed some 4,500,000 acres of land suitable for inclusion within the Forests.

The diminishing public lands still remaining unsettled are at present to a large extent unsuitable for agriculture, and the resulting inability of many would-be settlers to find homesteads on the public domain has led to an increasing pressure for the elimination of land from the National Forests. In some localities there is a demand for the elimination of cultivable timber lands. The problem thus presented is one of extraordinary difficulty. An investigation emphasizes the probability that heavily timbered lands, if opened to entry, would pass into the hands of large owners of timber. Of 705,000 acres eliminated from the Olympic National Forest in 1900 and 1901 on the ground that the land was chiefly valuable for agriculture and that the settlement of the country was being retarded, 523,720 acres passed ultimately into the hands of owners who are holding it purely as a timber speculation. Three companies and two individuals own over 178,000 acres, in holdings of from 15,000 to over 80,000 acres each. Of timbered homestead claims on this eliminated area, held by 100 settlers, the total area under actual cultivation is only 570 acres, an average of but 5.7 acres to each claim. It will be seen that the original purpose of the elimination was defeated, and that bona fide settlement was not materially advanced.

The changes in gross area are shown by States in the following table:

National Forest gross areas, in acres, by States.

State or Territory.	Area July 1, 1909.	Additions.	Eliminations.	Area July 1 1910.
Arizona	15,258,861	18,115	62,231	15,214,745
Arkansas	3,189,781	.....	.....	3,189,781
California	27,968,510	.....	.....	27,968,510
Colorado	15,698,439	[a] 80,819	287,467	15,491,791
Florida	674,891	.....	.....	674,891
Idaho	20,099,029	.....	135,858	19,963,171
Kansas	302,387	.....	.....	302,387
Michigan	163,373	.....	.....	163,373
Minnesota	1,204,486	.....	.....	1,204,486
Montana	20,389,696	.....	[b] 915,000	19,474,696
Nebraska	556,072	.....	.....	556,072
Nevada	5,109,415	.....	.....	5,109,415
New Mexico	10,971,711	363,979	195,567	11,140,123
North Dakota	13,940	.....	.....	13,940
Oklahoma	60,800	.....	.....	60,800
Oregon	16,221,368	[c] 604	301,150	15,920,822
South Dakota	1,294,440	.....	.....	1,294,440
Utah	7,436,327	.....	25,170	7,411,157
Washington	12,065,500	.....	58,160	12,007,340
Wyoming	8,998,723	.....	[d] 57,042	8,941,681
Total in United States	167,677,749	463,517	2,037,645	166,103,621
Alaska	26,761,626	.....	.....	26,761,626
Porto Rico	65,950	.....	.....	65,950
Grand total	.....	.....	.....	192,931,197

[a] 80,819 acres transferred to San Isabel from Las Animas National Forest.
[b] 915,000 acres of the Blackfeet National Forest was established as Glacier National Park
[c] 604 acres transferred to Wenaha from Wallowa National Forest.
[d] 56,320 acres eliminated from Cheyenne National Forest, but continued as military reservation.

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Of the total gross area approximately 11 per cent are State or private holdings. Owing to the changes consequent upon the eliminations of National Forest lands (often heavily alienated) made late in the year a corrected table of gross and net areas of the individual Forests can not now be given.

CLAIMS AND SETTLEMENT.

The public-land laws previously existing operated during the year to reduce the area of the National Forests through the perfecting of claims initiated before the Forests were created, the locating and perfecting of new claims under the mining laws, and the entry of lands applied for and listed with the Department of the Interior under the forest homestead law of June 11, 1906. A new method of passing Forest lands into private ownership, through the allotting of lands to Indians, was legalized by the act of June 25, 1910.

The opening of lands for Forest homestead entry and the allotment of lands to Indians is done by the Department of the Interior, upon the recommendation of the Secretary of Agriculture, after an examination of the land to determine its character and best use.

The determination of questions involving the title to land in National Forests is within the jurisdiction of the Department of the Interior. The Forest Service aids that Department in ascertaining the facts in regard to the validity or invalidity of claims. Persons holding valid claims under the public-land laws or legal title to land within the National Forests are free to occupy and enjoy their holdings just as fully as outside of the Forest. Any use of land outside of the claims must conform to the regulations of the National Forests. There is no restriction whatever to prospecting for minerals or to the location and development of mineral claims in the National Forests. When a mineral claim comes to patent it is examined by a Forest officer, who reports the facts as he finds them concerning compliance with the mineral laws by the claimant unless the land is of such character that its patenting will in no way affect National Forest interests, in which case no further inquiry into the facts is considered necessary. If there has been compliance with the law, the claim goes forward to patent without obstruction or delay by the Forest Service. Over 80 per cent of the examinations of mining claims and over 75 per cent of the examinations of all kinds of claims were followed by reports favorable to the claimant. It is the aim of the Forest Service to encourage the development of bona fide mining on the National Forests, and protest to the passing of title to mining claims is made only when it appears clear that the mining laws have not been complied with, and that a proper protection of National Forest interests makes protest necessary. This same principle is carried out in connection with claims which were initiated under other laws before the establishment of the Forest, as timber and stone claims and squatter claims.

Field examinations of unpatented claims led to reports to the General Land Office concerning 4,904, as follows:

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Reports to th General Land Office on unpatented claims.

Character of report.	Homestead entry.	Desert-land entry.	Timber and stone entry.	Mineral entry.	Coal entry.	Miscellaneous.	Total.
Favorable	1,611	29	522	1,519	79	5	3,765
Unfavorable	695	12	35	333	47	17	1,139
Total	2,306	41	557	1,852	126	22	4,904

Action upon claims to National Forest land before the Department of the Interior resulted as follows:

Claims to National Forest land disposed of by the Department of the Interior.

Character of action.	Homestead entry.	Desert-land entry.	Timber and stone entry.	Mineral entry.	Coal entry.	Miscellaneous.	Total.
Patent issued	700	12	328	602	2	18	1,662
Canceled	902	9	27	221	7	4	1,170
Total	1,602	21	355	823	9	22	2,832

The applications for and listings of National Forest lands for homestead entry under the act of June 11, 1906, are compared with those for 1909 in the following table. Such lands are listed when an examination, made at the request of the applicants, has shown that they are chiefly valuable for agriculture and not needed for public purposes. The total area listed since the passage of the law was at the close of the year 626,872 acres. The large number of claims shown as awaiting action at the close of the fiscal year is due partly to the fact that it was considered unnecessary to examine lands in areas shortly to be eliminated, but chiefly to the fact that applications accumulate during the winter months when examinations are generally impracticable. By the close of the field season most of the examinations here shown as applied for will have been made.

Applications and listings for forest homestead entry.

Fiscal year.	Number of applications during year.	Awaiting final action at close of year.	Number of tracts listed during year.	Acreage listed during year.
1910	5,216	4,193	1,751	183,211
1909	3,811	3,095	1,382	148,654

Since settlement within as well as near the National Forests is an aid to their protection and development, there is every reason for encouraging use for agriculture of land which can be properly listed. The act of June 11, 1906, is administered with a view to facilitating settlement. Decision on applications is made wholly on the basis of the fitness of the land for agriculture as against forest use, not with reference to the ability of the particular applicant to make a living

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from the land. Such questions as the strength or health of the applicant and his ability or experience in agricultural pursuits do not concern the character of the land and therefore have no place in any inquiry regarding it. A careful examination is made, however, to ascertain whether the land is capable of producing cultivated crops, and in deciding this the soil, climate, altitude, and slope must be considered. Lands valuable for grazing only are not listed under the act of June 11, 1906. If, however, a tract is found to be valuable for agricultural purposes and will produce crops, and adjacent nontimbered or sparsely timbered land is valuable for grazing purposes, an added area of such land may be listed with the agricultural land, provided that, except in the case of bona fide claimants who settled on the land before the National Forest was created, the area of the grazing land shall not exceed the area of the agricultural land. A person who settled upon unsurveyed land within a National Forest before its creation and has continuously occupied and is now occupying such land in good faith and in all respects complying with the homestead law, has the right to include within the lines of his homestead 160 acres after the land is surveyed. Therefore if the land is occupied for agricultural purposes and is not more valuable for its timber than for such purposes, and the claimant applies for the listing for entry of such land under the Forest homestead act, the examination is made with a view to listing 160 acres of land whenever possible under the provisions of the act. In cases where less than 160 acres have been listed for a person who settled upon the land prior to the creation of the Forest, an additional area sufficient to complete the homestead entry is allowed upon proper application, under the above conditions. Moreover, negotiations are now pending with the Department of the Interior whereby the surveyors of the Forest Service may be appointed deputy United States surveyors and the survey necessary to describe the land by metes and bounds made without expense to the applicant and accepted in final proof for issuance of patent to the land. By this means bona fide squatters who settled on unsurveyed land prior to the creation of the Forest, if the land occupied by them is not more valuable for its timber than for agriculture, may have their claims surveyed by metes and bounds, including the full 160 acres to which they would be entitled if they waited for the land to be surveyed in the ordinary way.

In the Swan River Valley, in the Flathead National Forest in Montana, very satisfactory progress was made in the examination and classification of lands with respect to their agricultural value. The agricultural possibilities of this valley and the eagerness of settlers to cultivate and make their homes on these lands led to a thorough investigation, and as a result the present classification was undertaken. There is a considerable area in this valley supporting a heavy stand of timber, but capable of producing excellent agricultural crops if cleared. The policy has been adopted of listing in practicable farm units, of not exceeding 160 acres, land upon which the value of the timber is not greater than the value of the land for agricultural purposes.

If land which would be good arable land when cleared supports a very heavy stand, the timber is sold in accordance with the regulations of the Forest Service, and the land is then classified for listing

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under the act. This precaution is taken to eliminate timber speculation and to encourage bona fide homesteading by persons who expect to till the soil and make the land their home.

In the Kootenai Valley, in the Kootenai National Forest in Montana, a similar policy was adopted. An agitation begun to secure the elimination of the valley from the Forest ended in an arrangement mutually satisfactory to the intending settlers and to the Forest Service, under which the agricultural portions of the valley will be taken up under the Forest homestead act. Sales of timber are being made as rapidly as possible from agricultural areas having a heavy stand, and the land will be listed as soon as the timber is removed.

These instances illustrate the manner in which is being worked out a practicable policy to limit occupancy of cultivable timber lands to bona fide settlers, so that the lands may be devoted to their best use and the permanent development of the country may be promoted. Such a policy is necessary that the very purpose for which the land is listed may not be defeated by the passing of the land into the hands of those who wish it for its timber instead of into the hands of home makers.

ENFORCEMENT OF LAW.

Owing to the transfer of the legal work of the Forest Service to the Solicitor of the Department, on January 15, 1910, the personnel of the force engaged in that work passed beyond the jurisdiction of the Forester. For this reason no reports were made to the Forester by the former District law officers. It is therefore impracticable to give a résumé of the work done prior to the transfer. The report of the Solicitor, although it covers specifically only the latter part of the year, presents substantially the progress made since last year's report in legal matters connected with National Forest administration.

At the beginning of the year, however, there were pending on the records of the supervisors' offices 290 cases of timber trespass, 32 of fire trespass, 42 of grazing trespass, and 37 of special-use trespass. There were added during the year 352 cases of timber trespass, 62 of fire trespass, 342 of grazing trespass, and 40 of special-use trespass, making a total of 1,197 trespass cases to be handled. Of these, 181 cases were dismissed, 552 closed by settlement, and 38 prosecuted in the courts, leaving 426 cases still on the supervisors' books at the close of the year.

Various court decisions of importance in connection with the work of the Forest Service are commented on in the report of the Solicitor.

The enforcement of laws relating to the National Forests of necessity falls primarily upon the officers who administer the Forests. In all cases where action in the courts is necessary to enforce the laws relating to the Forests the evidence is secured by the Forest Service and submitted to the Solicitor for examination into its sufficiency and for submission by the Secretary to the Attorney-General with request for institution of proceedings, if the evidence warrants. The evidence in all grazing trespasses of an innocent nature, which are settled by the Secretary without suit, is also secured by the Forest Service and submitted to the Solicitor for examination and report to the Secretary. Adverse reports on claims to lands in the National Forests are made on the evidence secured by the Forest Service.

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The procedure in force at the close of the fiscal year provided that these reports and accompanying evidence should be referred to the Solicitor for examination into their sufficiency to sustain adverse proceedings in the Interior Department. If found sufficient, upon the recommendation of the Solicitor to the Secretary a letter to the Secretary of the Interior requests action looking to the ordering of a hearing to determine the validity of the claim. Certain proposed modifications of this procedure are set forth under "Work for the ensuing year" (see p. 60).

COST AND USE.

The following tables show the cost of administration and protection, expenditures for permanent improvements, and receipts from the several sources, both in totals and per acre, during the year, as compared with those for the fiscal year 1909:

Expenditures for administration and protection and permanent improvements during the fiscal year 1910, compared with 1909.

Fiscal year.	Administration and protection.		Permanent improvements.	
	Total.	Per acre.	Total.	Per acre.
1910	$3,752,316.91	$0.01894	$598,835.64	$0.00310
1909	2,948,153.08	.01510	599,471.02	.00309

The per acre expenditures are here computed on the basis of the gross area of all National Forests under administration at the close of the year, since private holdings within the exterior boundaries of the Forests do not appreciably lower the cost of administration and protection.

Comparison of receipts from the several sources for fiscal years 1910 and 1909.

Fiscal year.	Timber.		Grazing.		Special uses.		All sources.	
	Total.	Per acre.	Total.	Per acre.	Total.	Per acre.	Total.	Per acre.
1910	$1,043,428.20	$0.00541	$986,909.38	$0.00512	$59,810.50	$0.00031	$2,090,148.08	$0.01084
1909	736,102.08	.00379	1,032,185.70	.00532	38,982.88	.00020	1,807,270.66	.00931

Refunds of excess deposits (as, for example, deposits made by buyers of timber in advance of cutting) have not been deducted from the receipts given above. The refunds of timber receipts in 1910 amounted to $31,584.82, and of all receipts in 1910 to $48,966.86. A deduction of the refunds would leave the total of receipts for 1910 $2,041,181.22, as against $1,767,171.93 for 1909.

Grazing receipts for 1910 were paid by the holders of 20,692 permits to graze 1,497,570 cattle, horses, and hogs, and of 4,995 permits to graze 7,648,950 sheep and goats. The receipts from timber sales were paid by 5,398 purchasers, who cut the equivalent of 379,616,000 board feet of timber. The receipts from special uses were paid by

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the holders of 4,538 permits, including 171 for the use of land in connection with water-power development. These receipts represent profitable use of the Forests by over 30,000 contractors and permittees.

The most important form of special use of National Forest land is its use for the development of hydro-electric power. During the year careful consideration was given to revising the form of agreement under which such use of National Forest land is permitted. All the details of the proposed new forms have been discussed, point by point, with representatives of power companies and with capable engineers, in order to insure conditions entirely fair both to the interests of the public as represented by the Government and to private interests desirous of occupying power sites, under the simplest and least cumbersome procedure.

The essential features of the new permit and stipulation, which will replace the old agreement, can best be brought out by comparing the new with the old. Under the latter the Government charged for occupancy of its land by a power company an annual sum computed on the basis of the actual output of energy, with a deduction for water used by the company from artificial storage supplies which the company may have created. Deductions were also allowed in proportion to the part of the total drainage basin not contained within National Forests, and for various other specified reasons. Determination of the amount to be collected, therefore, involved constant measurements, both of the actual output of power and of the water flow from storage reservoirs, where these had been constructed. This meant both much trouble to the Government to find out what to charge and fertile grounds of dissatisfaction and dispute. Further, the old form of agreement did not seem to provide sufficient safeguards against the speculative holding of sites without prompt development of the power.

The new rate will be based, primarily, on the value of the land occupied for power purposes, as measured by its capacity for the development of power, with a deduction for distance from market and for portions of the land to be occupied which do not belong to the Government. A fixed rate of $1 per net electrical horsepower per year is the full charge. This rate is equivalent to one sixty-sixth of a cent per kilowatt-hour, which is about one-thousandth of the rate at which power is generally supplied for lighting purposes and about one two-hundredths of the average charge for all purposes. It is therefore so light that it could under no circumstances constitute an obstacle to development. Compared with the fixed charges which represent the cost of construction of a power plant, the charge made by the Government would not amount to more than one-half of 1 per cent of these charges.

In imposing this charge it is recognized, on the one hand, that there will be a nonproductive period followed by a partially productive period before the company occupying the land will be in position to profit by the full power capacity of the site, and, on the other hand, that dilatoriness in pressing forward development may be encountered if collection of the charge does not begin until after the plant is in operation, for water rights may be acquired rather with a view to preventing them from falling into the hands of some one else than with a view to putting them to immediate use. Therefore, from the time the permit is granted, the permittee must pay

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the charge annually. But up to the tenth year, when complete development should have been secured, the rate is a reduced one, and amounts paid during the nonproductive period are credited against the rentals which will be due during the period of partial production. Hence permittees do not eventually pay for occupancy of the land during the period when the power must continue to run to waste, but they are compelled to make annual payments, which preclude the tying up of power sites in order to restrict production and thereby maintain high rates to the consumer.

Fundamentally, the course of the Forest Service in handling water-power questions rests on three principles: (1) That the Government as owner of the land has the right to fix the conditions under which a private individual may take possession of it for private business use; (2) that as trustee for the public it is the duty of the Government, on the one hand, not to permit the use of public property without securing a due return to the public, and on the other hand, that this return should not be obtained on terms which could in any way lessen the supply to the public of an important industrial commodity; and (3) that it is the duty of the Government, in the public interest, to prevent the tying up of power either by speculators who initiated rights with a view of selling them out at a high price or by those who would prevent full development of the potential power supply in the interest of market control.

This policy in no way conflicts with or diminishes the power of the States to regulate corporations engaged in the supply of hydro-electric power. It is considered, for example, that any regulation of rates charged the consumer which may be necessary will naturally be undertaken by the States. Neither is any attempt made at Federal regulation of the corporations engaged in the development of electrical power as corporations. The Federal Government takes cognizance of the matter simply because, as the owner of title to land held in trust for the people of the United States, it is in duty bound to promote the full development of the natural resources of the land, without directly or indirectly handing them over to private individuals for their exclusive use and benefit.

A serious if not insurmountable obstacle to the satisfactory handling of water power use of the National Forests is the inability of the Secretary of Agriculture, under the present law, to grant any permit not revocable at will. Naturally, capitalists are slow to invest large sums in enterprises which have no assurance of permanent rights. It is highly desirable, therefore, that there should be legislative authority for the granting of a permit irrevocable for a considerable term of years, except for the breach of the conditions of use fixed by the permit itself.

To the use of the Forests shown in connection with the statement of receipts must be added the very large use for which no charge is made. For the free use of timber see page 26. No permits are issued and no record is kept of the free grazing on the Forests, and therefore an exact statement of it can not be given. Milch cows, work animals, and horses in use, not exceeding 10 head for any one owner, may be grazed free by settlers within or near the Forests, and by prospectors, travelers, and campers. In Arizona and New Mexico 30 milch goats may be grazed without charge. Free grazing is also allowed for all horses in use by stockmen and by purchasers of timber on the Forests.

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Of free special-use permits there were issued during the year 2,986—practically the same number as the year before. The number of such permits in effect at the close of the year was 6,989, as against 5,540 one year previously.

EXECUTIVE FORCE.

The following table shows the classification of the Forest force, including field men temporarily assigned to District offices, on June 30, 1910:

Supervisors	140
Deputy supervisors	106
Rangers	1,293
Guards	558
Forest assistants	97
Field assistants, timber and mining experts, engineers, hunters, etc	156
Clerks	186
Total	2,536

It will be seen that the transfer of the greater part of the executive work and responsibility connected with the National Forests to the Forests themselves, which has been going on gradually for the past three years, has been largely accomplished, since only 18 per cent of the entire enrollment (3,091) of the Forest Service are engaged in administrative, executive, scientific, and the requisite clerical work in localities other than on the National Forests.

All the National Forests in the continental United States and Alaska, embracing a total of 192,865,247 acres, were under administration at the close of the year. The number of rangers and guards was 293 more than for the preceding year, reducing the average area to each such officer from 125,065 acres to 104,307 acres, or approximately 163 square miles. This reduced amount of territory (obviously still much too great) per man, was more than offset by the constantly enlarging demands due to increasing use of the Forests. So small a protective force is in the highest degree uneconomical. It exposes the vast supplies of National Forest timber to an unnecessary peril, while at times when, through drought and other unavoidable natural causes, the Forests are attacked by serious fires, heavy emergency expenditures must be made to put out conflagrations which ought never to have gathered headway. The peril of loss by such fires is not confined to public property.

Because of the increasing responsibilities imposed upon rangers as overseers of work and as agents of the Government in dealing with users, the civil-service examination for assistant forest ranger held in October, 1909, was strengthened by requiring a rating on general education as well as experience. The minimum entrance salary paid assistant forest rangers was raised January 1, 1910, from $900 to $1,100 per annum, making the pay more commensurate with the quality of service expected. A readjustment to this minimum of the salaries of men already in the Service did much to lessen the danger of failing to attract and hold, in competition with the fields of outside employment, the best type of men. For similar reasons, the minimum entrance salary paid technically trained foresters was raised on July 1, 1910, from $1,000 to $1,200 per annum.

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To increase the efficiency of Forest officers, the plan of holding conferences for discussion of administrative problems and instruction in the best methods of caring for the Forests was continued. There were held during the year 54 such meetings of supervisors and rangers, of which 45 were attended by representatives of the district offices. The Utah Agricultural College, the Colorado State Agricultural College, the universities of Washington and Montana, and other similar institutions provided short winter courses to prepare men for efficient forest work. The detail of 208 rangers to attend these courses was held by the Comptroller of the Treasury to involve the illegal expenditure of public money and necessitated the disallowance of all charges for this purpose. Immediately upon the rendering of this decision steps were taken to recover all disbursements which had previously been made, so that no permanent loss to the Government resulted.

BUSINESS ORGANIZATION.

The organization of the Forest Service was changed on January 15, 1910, by a transfer of all its legal work to the Solicitor of the Department of Agriculture, and of its fiscal affairs to the Division of Accounts and Disbursements in the Department. The organization was further changed on February 5, 1910, by removing from the Branch of Operation the administrative control of the work connected with agricultural settlement, claims, ranger stations, occupancy, trespass, and uses, and placing it under a newly formed Branch of Lands, with a corresponding Office of Lands in each District office. The boundaries of the districts were not changed during the year.

The move toward decentralization, which led during the previous year to the establishment of the District offices, was carried a step further by increasing the responsibility placed upon local Forest officers. The number of officers and clerks regularly employed in the District offices was reduced by 146, and their work transferred to the National Forests. In continuance of the plan devised to increase the efficiency of Forest officers by giving them experience in the general executive work of the Districts, 103 men from the local force on the Forests were detailed, for an average time of one month, to assist in the work of the District offices.

During the year the Choctawhatchee and Ocala Forests, in Florida, and the Marquette and Michigan Forests, in Michigan, were put under administration. The Targhee, in Wyoming, the San Juan, in Colorado, and the Coconino, in Arizona, were subdivided into two separate administrative units each, and the Bonneville, in Wyoming, into three, while the administration of the Las Animas, in Colorado and New Mexico, was merged with that of the San Isabel Forest, and that of the San Luis, in California, with the Santa Barbara.

To provide for a proper consideration of the engineering problems involved in granting water-power permits, and to systematize the regulation of this use of the Forests in the interests of all concerned, a chief engineer was appointed, responsible to the Chief of the Branch of Lands, to pass upon all technical questions involved in water-power development. When a special-use application for lands needed for power purposes is received in the District office, an examination is made on the ground by a competent engineer, whose report and recom-

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mendations are passed upon by the chief engineer. If the report is favorable to the applicant, a power permit is prepared, and, when approved by the Forester, is submitted to the Secretary of Agriculture.

FOREST MANAGEMENT.

STAND AND DISTRIBUTION OF NATIONAL FOREST TIMBER.

Last year's report gave the total stand of timber on National Forests exclusive of Alaska as 400,000,000,000 feet. More accurate knowledge has led to a revised estimate, which raises the total to approximately 530,000,000,000 feet. For the two National Forests in Alaska not even a rough estimate can be made, though the stand is believed to be very large. The estimate of total stand given above should be considered as only an approximation, which will be subject to further change as more accurate surveys of the timber resources on each Forest are made.

About 62 per cent of the total estimated stand on the National Forests exclusive of Alaska is in the three Pacific Coast States, 21 per cent in Idaho and Montana, and 12 per cent in Arizona, Colorado, and New Mexico. This leaves only 5 per cent elsewhere. In the order of their importance, the five States containing the bulk of National Forest timber are Oregon, California, Washington, Idaho, and Montana.

LOSSES BY FOREST FIRES.

The loss of National Forest timber from forest fires can be reported only for the calendar year 1909, since the record of fires is kept by seasons, not fiscal years. The record for 1909 showed improvement over that of 1908. The area burned over was 362,014 acres, of which 209,671 acres were timbered, as against 414,638 acres, of which 252,382 acres were timbered, the previous year. The loss in timber destroyed was 169,410,000 board feet, with an estimated value of $297,275, as against 232,191,000 board feet, worth $451,188, in 1908. Of 3,138 separate fires reported, 2,464 were extinguished without extra help or expense by the Forest officers discovering them. This was an increase, as compared with the previous year, of 410 in the total number of fires reported and of 375 in the number extinguished without material damage. The increase in the latter class is wholly attributable to fires on the Coeur d'Alene Forest, on which 657 minor fires were reported for 1909, as against only 84 for 1908. Locomotive sparks were given as the origin of 611 of the fires on this Forest in 1909, while for 1908 only 9 fires from this cause were reported.

In the organization and administration of the National Forests the most important consideration is their protection from fire. In a Forest fully organized, with adequate means of transportation and communication and a sufficient force of rangers and guards, the risk from fire is very small. In foreign countries in which forests are so organized the risk is so small that the forests are insurable at a moderate rate.

Full protection of the National Forests from fire will be brought about just as rapidly as possible. It requires (1) the removal of the

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causes of fire, (2) a proper organization and equipment of the Forest for protection, and (3) efficient patrol.

The causes of fires on the National Forests may be summarized as follows: Sparks from locomotives, sawmills, donkey engines, etc., camp fires, clearing land and burning brush, burning to improve pasturage, careless smokers, incendiarism, and lightning. With the exception of lightning, all of these causes are controllable.

Of last year's fires, 84 per cent were due to lack of preventive care on the part of the users of the Forests and of the railroads traversing them. During the calendar year 1909 railroad locomotives caused 1,186 fires. The railroad companies realize that such fires are against their own interests and have shown an admirable spirit in cooperating to prevent them. Cooperative agreements with the Great Northern and the Northern Pacific railroads provide for the cleaning up of inflammable material in the rights of way, an effective patrol of the line, free transportation by the railroads of Forest officers, temporary laborers, and supplies, and payment by the railroads of bills for temporary labor and supplies used in extinguishing fires which start within a prescribed distance of the tracks. Similar agreements with other lines are pending, and informal understandings were reached with railway lines in Colorado for the clearing of their rights of way. In spite of these efforts, however, fires are constantly started from locomotive sparks, and it is imperative that this cause of fire be eliminated. The railroads should be required either to use efficient spark arresters or to burn oil. It is contended by the railroads that there is no spark arrester which does not, in practical use, interfere with the draft of the engine. A number of new spark arresters are now being thoroughly tested, and there is every indication of their success.

The use of oil as fuel brought ideal results. The Chicago, Milwaukee and Puget Sound Railroad uses oil-burning engines passing through the Forests of the Northwest. During the summer of 1910, which was disastrous for forest fires, reports show that not a single fire was started from the engines of that company. On all lines using sparking fuel repeated fires were started, in some cases 25 to 30 fires in a single day within a stretch of 50 miles.

Carelessness in leaving camp fires, in clearing land, in burning brush, and in smoking results in an enormous number of fires. Control of these causes of fires means educating the public to a proper sense of responsibility. A much closer patrol to see that care is taken and to put out in their incipiency any fires which may start is also needed.

The burning of the Forests to improve grazing is really incendiarism. During the calendar year 1909, 4 per cent of the forest fires were incendiary in origin. Incendiarism can be stopped, partly through education of the public and partly through increased watching of the Forest, which will result in the apprehension and punishment of incendiaries. As soon as the local public appreciates the disastrous effects of forest fires and gives the Forest officers the fullest support in preventing incendiarism, it will stop very quickly. The apprehension and swift punishment of a few culprits will also have a very beneficial effect.

Lightning is particularly dangerous because whereas fires started by human agency are most likely to occur near settlements, railroads,

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lumber camps, and in general where labor and supplies are obtainable and means of communication developed, electrical storms are at least as common in rough and wild high-mountain country, far from roads and trails, as in more easily protected parts of the Forests. It is estimated that during the year 1909, 12 per cent of the fires were started by lightning. This is the only cause of fires which can not be controlled; all that can be done is to provide adequate patrol, open communications, and thus be prepared to put out fires as quickly as possible after they start.

Frequently fires originating on private land spread to the National Forests. Such fires do great damage to private lands as well as endangering the Government timber. In Washington, Oregon, Idaho, and western Montana many large private owners have formed cooperative fire associations. These associations are doing admirable work, in many cases placing a larger patrol in their forests than the Government has been able to employ with the resources at its command. The Forest Service is cooperating very closely with these associations and also with private owners in the above-mentioned States and in California who are not members of the associations. In District 1 the cooperative agreements with the Pend Oreille, Coeur d'Alene, Potlatch, and Clearwater timber protection associations and with three large lumber companies provide a system of patrol which did much to keep down both public and private fire losses. In District 5 similar results were obtained through agreements with two large companies, one of which owns 60,000 acres of timber land within the Tahoe National Forest.

The National Forests are enormous in extent and very sparsely populated. In many sections there is not a keen responsibility in the matter of their protection, and sometimes there is active hostility among a certain number of individuals. To protect these Forests is an important public duty, for every year brings the time nearer when their supplies of timber will be indispensable, while their yield in water is indispensable now. Protection requires in the first place a reduction as rapidly as possible of the inflammable material. In the disposal of timber from the National Forests, whether by sale or under free use, one of the requirements is that the tops and other slash shall not be left as a fire trap. The fire menace is further reduced by utilization of dead timber wherever this can be brought about. A large part of the timber cut under sales, and four-fifths of the timber removed from the Forests under free use, is dead timber. It is also the policy to reduce as fast as possible the old slashings due to lumbering before the Forests were created. This is slow work on account of the large amount of such material. Yet the aggregate yearly reduction of the material which adds to the fire risk is an important result of National Forest administration.

The proposal has been made that the Forests should be burned over every year or two in order to prevent the accumulation of vegetable litter on the ground. It has been alleged that the fires which were set in the early days by the Indians and first settlers were beneficial. As a matter of fact, these early fires were enormously destructive. Many of them were much more destructive than the fires of the season of 1910 or of any other recent year. There are a few open Forests of mature timber where the ground might be

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burned over annually or periodically by a light fire under complete control without injury to the Forest. The stands where this is feasible are primarily in the open yellow-pine forests. If this plan were adopted in such stands, the expense would be very large, because it would be necessary to keep the fire under absolute control and to keep it out of the younger stands, which if burned would be destroyed or very seriously injured. But in most of the National Forests there are immature trees and young growth scattered among the older trees. The annual or periodic burning of such Forests would be utterly out of the question unless the idea of continued forest production were entirely given up. If the future interests of the Forest were to be sacrificed in order to protect the scattered large individual trees which would be capable of resisting these fires, then the plan might be adopted. It is inconceivable that there should be seriously advocated a treatment of the Forest which would inevitably result in the very rapid diminution of its density to a point where ultimately there would be no timber at all. This process has been demonstrated over and over again in the parts of eastern forests, which have been repeatedly burned and where to-day there is practically a barren waste.

The principle of burning the surface of the ground to prevent the accumulation of forest litter is applicable, therefore, to an exceedingly limited area, and its application is expensive. It should be applied not in burning over the whole surface, but in clearing broad and well-placed fire lines. Thus in the yellow-pine forests fire lines burned here and there may be effective breaks to stop incipient fires. As a matter of fact, there has been no difficulty in protecting these open yellow-pine forests. The Forests which it is difficult to protect are those of a character to which this plan is entirely inapplicable.

The first necessity is roads and trails and telephone lines; the second, more men. All the experience of the past emphasizes the value of trails and telephone lines. During the season of 1910, when on account of the drought and high winds the most difficult conditions of fire protection were encountered, it was proved that with adequate means of transportation and communication the fires were controllable. Thus, for example, along the railroads and near roads, the fires which were started were in most cases put out in their incipiency. The same was true in all Forests which were even moderately well equipped with roads and trails. In the Bitterroot Forest a very large number of fires started near valley bottoms, at the edge of the Forest. These were nearly all extinguished before they reached any considerable size; only one or two burned over more than a few acres. In the Lolo Forest, where trail construction has been well developed, of the many fires which started nearly all were rapidly brought under control. Over the Divide there are enormous areas of undeveloped and inaccessible forests, and fires which started in these swept over the Divide and destroyed a large amount of timber in the Lolo Forest. This was a clear demonstration of the disastrous effects when there are regions in which the fires can not be reached.

The Forest Service is also constructing fire lines. These fire lines stop small fires. No fire line will stop a crown fire. It is, however, a point of vantage for back firing against a crown fire.

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There have been established in many places signal stations for the use of the patrolmen in watching for fires. Usually these are located on high points from which a large area can be overlooked. In some instances, where the topography is flat, watch towers are built extending above the trees and so located that the observer may see a large portion of the Forest. An example is in the Tusayan Forest, near the rim of the Grand Canyon. A tower which is under construction in the Arkansas Forest will be provided not only with telephone communication with the ranger stations but also with a system of lights for signaling at night. In some instances the signal stations are equipped with means of flashing signals to a distance, where they are received by other patrolmen and passed on until some person is reached who can communicate by telephone with headquarters, whence help can be sent. Experiments are being conducted with the heliograph as a means for signaling.

The Forests not only must be thoroughly organized and equipped but also must have a sufficient patrol force. The Forests are now very much undermanned. Frequently a single patrolman has under his charge over 100,000 acres. During the dry periods there should be at least one regular patrol to every 10,000 acres in the heavily timbered Forests. In normal seasons when there is considerable rainfall patrol may be considerably reduced, but in exceptionally dry seasons, such as that of 1910, it should be possible to put a greatly increased force of guards on patrol duty.

Besides a protective force which is sufficiently large, proper organization of the Forests against fire demands also that this force shall be effectively distributed. In the absence of ranger quarters, in which the men may live while protecting remote parts of the Forests, patrol officers must return frequently to settlements for supplies, losing much time in going back and forth and leaving the Forests unguarded meanwhile. Satisfactory results can not be expected until the equipment includes a large number of ranger stations provided with cabins, barns, and pastures, so that men and their horses can be quartered where they are most needed.

The extra expense incurred in fighting fires in 1909, exclusive of the salaries of Forest officers, was $54,669.83, or $18,613.70 less than in the previous year. Of this total $17,162.82 was expended on account of fires not on National Forest lands, but seriously threatening the Forests.

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CUT OF NATIONAL FOREST TIMBER.

From the following table it will be seen that the total cut of National Forest timber last year was 484,412,000 feet. The cut of the previous year was 457,639,000 feet.

Timber cut from National Forests.

State or Territory.	Cut under sale.	Cut under free use.	Total cut.
	Feet.	*Feet.*	*Feet.*
Arizona	34,976,000	5,254,000	40,230,000
Arkansas	2,048,000	513,000	2,561,000
California	54,616,000	7,647,000	62,263,000
Colorado	42,897,000	12,550,000	55,447,000
Florida		95,000	95,000
Idaho	52,520,000	19,937,000	72,457,000
Minnesota	1,103,000	381,000	1,484,000
Montana	72,885,000	14,713,000	87,598,000
Nevada	3,048,000	1,710,000	4,758,000
New Mexico	15,902,000	10,004,000	25,906,000
North Dakota		21,000	21,000
Oklahoma	33,000	123,000	156,000
Oregon	21,211,000	10,068,000	31,279,000
South Dakota	13,500,000	3,476,000	16,976,000
Utah	9,270,000	8,260,000	17,530,000
Washington	27,658,000	2,444,000	30,102,000
Wyoming	16,937,000	7,416,000	24,353,000
Alaska	11,012,000	184,000	11,196,000
Total	379,616,000	104,796,000	484,412,000

TIMBER SALES.—There was a slight improvement in the lumber market over the preceding year, but not a full recovery. This improvement in market conditions is reflected in the sales of National Forest timber. The cut of the year under sales increased in amount about 8 per cent, and in value 34 per cent, while the sales of the year (largely of timber to be cut under operations which may extend over several years, but in no case over more than five) doubled in amount and rose nearly two and one-half times in value. The large increase in sales for cutting in the immediate future and the increase in the average stumpage price obtained are particularly noteworthy.

Sales of timber and the cut of timber under sales (partly made in previous years) were as follows:

Timber sold and timber cut under sales from the National Forests.

State or Territory.	Timber sold.		Timber cut under sales.	
	Amount.	Value.	Amount.	Value.
	Bd. ft.		*Bd. ft.*	
Arizona	45,399,000	$128,807.07	34,976,000	$95,058.28
Arkansas	2,077,000	4,933.73	2,048,000	4,503.14
California	69,000,000	162,952.48	54,616,000	102,613.75
Colorado	45,544,000	86,286.10	42,897,000	83,836.65
Florida	3,000	2.50		
Idaho	86,838,000	262,375.50	52,520,000	145,054.01
Minnesota	1,055,000	6,922.00	1,103,000	6,639.44
Montana	49,737,000	140,708.40	72,885,000	230,508.08
Nevada	2,865,000	6,269.84	3,048,000	7,691.79
New Mexico	19,067,000	28,865.66	15,902,000	29,934.22
Oklahoma	39,000	86.50	33,000	68.50
Oregon	21,679,000	45,641.06	21,211,000	45,508.22
South Dakota	10,474,000	21,421.04	13,500,000	51,426.22
Utah	14,377,000	33,616.48	9,270,000	20,326.18
Washington	81,636,000	187,435.91	27,658,000	49,767.42
Wyoming	109,283,000	267,238.65	16,937,000	40,485.82
Alaska	15,482,000	17,429.77	11,012,000	12,886.62
Total fiscal year 1910	574,555,000	1,400,992.69	379,616,000	896,308.34
Total fiscal year 1909	286,666,000	568,903.02	352,434,000	677,784.35

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These figures show an average stumpage price for 1910 of $2.44, as against $1.98 obtained in 1909.

The total value of the timber cut under sales as given above is less than the receipts from timber as given on page 10, both because the latter includes the receipts from timber and fire trespass and because payment for timber is required in advance of cutting.

The following table shows a considerable increase in the number of purchasers of National Forest timber. This increase is most marked in the large sales, as would be expected from the improved business conditions coupled with the fact noted in last year's report, that the depression then in evidence had caused a decrease in large sales but had not prevented a slight increase in the number of small sales, which are made to mills cutting for local consumption. This class of business may be regarded as less liable to fluctuation than that made up of operators on a large scale for the general market.

Number of timber sales.

State or Territory.	Under $100.	$100 to $500.	$500 to $1,000.	$1,000 to $5,000.	$5,000 to $100,000.	Total number of sales.
Arizona	899	9	3	2	2	915
Arkansas	54	.....	.....	1	.....	55
California	495	32	11	10	4	552
Colorado	704	27	23	21	.....	775
Florida	2	.....	.....	.....	.....	2
Idaho	488	50	8	18	10	574
Minnesota	.....	.....	.....	1	1	2
Montana	955	31	10	21	5	1,022
Nevada	226	6	1	.....	.....	233
New Mexico	212	19	6	6	.....	243
Oklahoma	40	.....	.....	.....	.....	40
Oregon	152	19	2	4	7	184
South Dakota	196	7	2	4	1	210
Utah	205	7	1	4	1	218
Washington	41	5	1	2	5	54
Wyoming	82	21	2	1	2	108
Alaska	174	36	.....	1	.....	211
Total fiscal year 1910	4,925	269	70	96	38	5,398
Total fiscal year 1909	4,625	229	53	57	16	4,980

In connection with these sales mention may be made of the fact that on the Choctawhatchee Forest, in Florida, six permits for turpentining operations were approved, which provide for 70,751 cups and will yield to the Government $4,238.50. The extraction of forest products other than timber from the National Forests has hitherto been altogether insignificant. If, however, experiments which are now under way shall prove that western pines can be made a commercial source of supply of naval stores the outlook for the turpentine industry will take on a new aspect and another important use of the Forests will have been opened. Under conservative methods of turpentining, and when operations are conducted in timber which is soon to be cut, this use can be permitted without danger of the destructiveness which has generally attended the boxing of southern pine forests for turpentine.

The object of National Forest timber sales is by no means solely the gathering of a harvest which nature has planted and matured. The supply of virgin timber in the United States is the heritage of centuries, and must soon give out unless a new investment is made. Silviculture is the making of such an investment. Most timber sales

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are planned with a view to securing, by one and the same operation, the ingathering of the ripened crop and the sowing of a new crop. The only cases in which this is not true are when the cutting is applied as a means of stimulating increased growth in established stands with utilization at the same time of the surplus material removed, and when the conditions are such that artificial reforestation will be resorted to in order to establish a satisfactory new stand. Taking care of an existing stand without provision for the growth of a new supply when all that is now growing is gone is not forestry, but enlightened lumbering and no more. The Forest Service is not merely protecting the present stock of timber on the National Forests in order to sell it off when opportunity arises; it is practicing forestry upon them.

From the standpoint of forestry the first need of the Forests is the replenishment of growing stock on the enormous acreage which has been fireswept in the past. Contrary to a prevalent belief the present stand is largely a depleted stand. Although the cutting in the National Forests in the past has been very limited, there has been an enormous destruction at different periods by forest fires. Because of the limited lumbering on the National Forests as a whole they are usually classed as virgin. Hence the common supposition that they are almost everywhere fully stocked with heavy timber. This is far from true. From time immemorial there have been forest fires in the western mountains, and there are evidences of fire in nearly every Forest. The ancient fires were doubtless started for the most part by the Indians and from lightning. Their result was a smaller average stand than the forests would otherwise have borne. With the advance of settlement many fires started along the railroads and through carelessness of the early hunters, prospectors, and settlers. These fires not only were very numerous, but often covered enormous areas and destroyed great bodies of timber. In some cases very extensive forests were entirely wiped out.

When a Forest is destroyed by fire, there is a gradual restoration of the original conditions. If the clearing is very large and all seed trees were destroyed, this natural replacement of the Forest may take centuries. There are to-day, in every Forest, areas covered by immature timber of different ages, and there are also very extensive areas, burned within the last half century, which are to-day practically devoid of trees, or very sparsely covered with them. In short, as a result of past fires the National Forests are in a condition more like that of eastern forest regions in which lumbering and fire together have left some areas stripped, some reproducing imperfectly, some covered with half-grown timber, and some still untouched, than like a normal virgin forest. Conditions differ in the two regions less in kind than in the point to which the process of destruction has advanced.

It is the policy of the Government to put to use the timber which is mature, to protect carefully the trees worth leaving for further growth, to replace promptly by new growth timber which is cut and utilized, and to extend the Forest by artificial sowing or seeding over the areas stripped of timber by previous fires.

So far as practicable, the aim is to cut first those bodies of timber which have passed maturity and have begun to deteriorate. The disposal of such timber, however, is dependent on the demand for it. Often the stands which are in the most need of cutting are remote

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from the market and could not be removed without great sacrifice in price, and usually by sacrifice at the same time of timber which is thrifty and which ought to be left for cutting at a later period.

The timber-selling policy is based on principles of broad public economy. The timber is sold when there is real demand for it. Sales are not forced merely in order to secure revenue for the Government. When there is a demand for National Forest timber which should be cut, a fair minimum price is fixed and the timber is offered at public sale. An attempt to force sales is made only when timber has been killed by fire or is threatened by insect attack. Low prices are then accepted to bring about utilization before the timber becomes altogether worthless. A large amount of dead standing timber on the lands which were burned over in the great fires of the season of 1910 will be offered for sale during the coming year.

As yet the annual sales are far below the annual growth. It is the purpose not to sell more timber each year than is grown. Further, since it would not be proper to exhaust the Forests of one region because there is an abundant reserve supply in another region, the design is to maintain continuous local supplies. The output in a given region is therefore restricted to the actual production in that region. Usually each Forest is handled as a single unit, and the annual cut restricted to the growth on that Forest. Occasionally, as when there have been severe fires and a large amount of timber killed, there may be sold in a single year on a given Forest considerably more than is produced by growth.

At the beginning of each fiscal year the maximum amount of timber which can be cut from each Forest during the year is fixed by the Secretary of Agriculture. This amount can not be exceeded without his express authority. Since the estimates of growth have so far been necessarily rough approximations, care has been taken to have the cutting conservative.

In the majority of sales so far made, natural reproduction is relied upon to restock the cut-over areas; but in some instances, where satisfactory natural reproduction can not be secured, artificial restocking by planting or reseeding is resorted to.

The methods of cutting necessarily vary greatly. No single method is applicable to all Forests. In any given case the method used must depend not only on the composition and character of the Forest, but also on the logging conditions.

In many Forests trees of all ages are mingled together, individually or by groups—old mature trees, thrifty trees of immature age, young saplings, and small seedlings. Under such conditions the old trees are selected here and there, while the trees not yet mature are carefully protected and left as a basis for a later cutting. The trees left are capable of distributing seed over the openings made by the lumbering, and reproduction is thus secured. This is called the selection system. Each tree which is to be removed is selected and marked by a Forest officer. In the contract for cutting there are provisions for the complete utilization of the trees which are cut, for the protection of the trees left standing and of young growth, for the disposal of the slash made in the lumbering, and in various other particulars for the protection of the interests of the Government and the welfare of the Forest.

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In some stands the trees are for the most part of the same age, and all mature. This is a common occurrence where, after fires, the burns have been restocked by a stand of relatively even age. The selection system is not applicable to such conditions. In some cases the best procedure is to remove the stand in two or more cuttings. The first cutting is in the nature of a thinning, which removes about 50 or 60 per cent of the stand. So far as possible, the trees left are thrifty individuals which will make substantial growth during the next twenty or thirty years. The design is to return after from ten to thirty years and remove part or all of the remaining trees. The opening of the stand by the first cutting results in establishing a new crop under the shelter of those left. This is called the shelter-wood system. It has been used very extensively in the National Forests. In the Black Hills, for example, even-aged yellow pine stands have been cut in this way, with a removal of about 60 per cent of the stand in the first cutting. The same method has been applied also in stands of lodgepole pine and other species.

In some instances, where practically all the trees are mature and the conditions are such that the shelter-wood system is not applicable, all of the stand is cut except a limited number of seed trees, left either as scattered individuals or in scattered groups. This system of clear cutting, with scattered seed trees, has been used on a large scale on the Minnesota National Forest. It has been in operation since 1904. From 5 to 10 per cent of the timber is left to produce seed. The results have varied; in some parts of the Forest they have been very satisfactory; in other parts less so. There has been some windfall of seed trees, especially on the earlier cuttings; on the later ones a more skillful selection of the trees to be left minimized the loss. On portions of the area reproduction is coming in very successfully; on other portions slowly. Such deficiencies call for supplemental planting to provide a full stand. The chief obstacle to reproduction is the competition with brush and other vegetation, which has sprung up very abundantly on the clearings. The best results are obtained under this system if the ground is burned over just before or during a seed year, since this facilitates the establishment of a new forest growth in competition with the other vegetation.

Not uncommonly the danger from windfall is so great that any system of thinnings of the stand is impossible. Under such circumstances it would not be practicable to leave individual trees or groups of trees for seed distribution. A clear cutting must then be made. If natural reproduction is relied upon, the clearings must be small enough to allow the distribution of seed from the surrounding stands. A method which has been used is to cut the timber clear in narrow strips. Where the topography is comparatively uniform and logging difficulties do not prevent, strips from 100 to 300 feet wide are cut, each separated by a band of timber of approximately the same width as the clear strips. This results in the removal of about half of the timber. The design is to return at a later date, after reproduction has occurred on the strips, and remove and reproduce the intervening strips. At the time of the second cutting, from ten to thirty years hence, it will be necessary to resort to artificial reproduction if the danger from windfall is so great that none of the systems of natural reproduction is applicable.

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Not uncommonly there are restricted stands of very old timber surrounded by stands of younger trees. This very frequently happens in the Cascade Mountains. The clear cutting of the old timber is required because nearly all of the trees are mature and of very large size. It would not pay to leave trees for seed, even if it were safe from the standpoint of windfall, because the trees are so large that the value of the investment would be fully equal to that involved in artificial planting, while their removal after the young growth had started would do great damage. Where the area of the clearing is not large, natural reproduction is relied upon from the surrounding stands. In the case of Douglas fir on the Pacific coast, clearings may often be made from 500 to 1,200 feet across with a reasonable expectation that good natural reproduction will follow. It has been clearly demonstrated that on such clearings natural reproduction is successful where the ground is burned over and the débris and thick layer of litter is destroyed. Where the clearing is so large that natural reproduction can not be relied upon, those portions which can not be reached in the natural distribution of seed must be restocked artificially.

With the further development of forestry, many stands will be clear-cut and restocked at once by artificial seeding or planting. So far but little of this has been done except to supplement natural reproduction. The efforts of the Forest Service in artificial reproduction have been largely confined to the extension of forests on land on which the forest has been destroyed by fire.

In all cutting operations the trees which are to be removed are carefully designated. If the operation is in the nature of a thinning, each tree to be cut is marked by a blaze and stamped with a marking ax. If there is a clear cutting the boundaries of the clearing are designated by a line of blazes. If all trees but a few scattered individuals are to be cut, the trees which are to be left standing are marked.

Heretofore it has not been possible to do much improvement cutting in immature stands. Such cuttings are designed to remove trees which are dead or dying, or of poor species. The thinning of immature stands which are overcrowded results in a very large increase of rate of growth, and the stand is brought to maturity in a shorter time. It is possible to do such improvement work in the Forests where there is a market for small poles and for cord wood.

The recent timber-sale operations have shown a great advance in the skill with which natural reproduction has been provided for; but on account of the present market conditions in most of the National Forests, the silvicultural work is necessarily crude compared to European practice and to that in the regions of good markets in the East.

TIMBER TRESPASS.—Payments in settlement of timber trespass during the year amounted to $35,775.55, including $634.08 for fire trespass, as against $43,109.39 for the previous year. The amount received during the fiscal year ending June 30, 1907, in settlement for timber cut in trespass was $65,536.32, and during 1908, $55,405.76. These figures show that the amount received in 1908 was 15 per cent less, in 1909, 34 per cent less, and in 1910, 45 per cent less than it was during the fiscal year 1907. This gradual and substantial decrease

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is due in a large measure to the increasing efficiency of Forest officers and the general improvement which has been going on from year to year in the management of National Forests.

FREE USE OF TIMBER.—The timber cut under free-use permits represented about 21.6 per cent of the total cut of the year. The amount and value of this timber is shown below:

Free use of timber on National Forests.

Fiscal year.	Number of permittees.	Cut.	Value.
		Board feet.	
1910	35,364	104,796,000	$176,166.51
1909	33,431	105,205,359	169,081.12

REFORESTATION.

There are two distinct problems of reforestation: First, the replacement of the Forest by new growth after the removal of the timber to be cut, and second, reforestation of land which has been cleared in the past by fires, lumbering, and other agencies.

In most of the cuttings conducted on the National Forests natural reproduction is relied upon to replace the timber removed. The methods of cutting in order to secure this natural reproduction have been described on pages 23–25. There are many old burns which are being reproduced rapidly by natural means. Where the openings are small the seed is often furnished in sufficient abundance from the trees surrounding the clearing. Where the burn is incomplete and individual trees and groups of trees are left here and there, satisfactory natural reproduction is secured. Sometimes a fire burns through a Forest during a seed year, killing the trees but not consuming or destroying the vitality of the seed. This seed is then distributed over the burned ground, and reproduction takes place almost immediately after the fire. Examples are found in the marked natural reproduction after some severe burns in lodgepole pine.

Since the National Forests were placed under protection from fire, natural reproduction has been taking place very vigorously, and the Forests whose density has been much reduced by fires and lumbering are rapidly filling up with new growth. On the extensive burns, however, where all the seed trees have been destroyed, reproduction must creep in gradually from the edge. Often many tree generations are required to cover over a large burn. Where the climatic conditions are critical, such reproduction is exceedingly slow, and there are sometimes areas where it will be many decades before there will be even the beginning of the establishment of a new stand by natural means.

It is the policy of the Forest Service to reestablish by artificial means, as rapidly as possible, the Forests on such areas as will not within a reasonably short time be reforested naturally. The work of artificial reforestation has hitherto progressed slowly: First, because it was necessary to devote the first efforts to the organization of the Forests, building up a corps of trained men and developing a system of protection from fire; and, second, because it was necessary to do a large amount of experimental work in seeding and planting in order to determine the best methods of work.

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Where as a result of previous experiments methods of seeding and planting were well understood, work was undertaken on a considerable scale. The largest areas planted were on the Pike, Kansas, Nebraska, Pocatello, Uinta, Wasatch, Angeles, Cleveland, Santa Barbara, Columbia, and Michigan National Forests. The most extensive direct seeding was as follows: On the Siuslaw, 1,750 acres; on the Oregon, 1,300 acres; on the Black Hills, 788 acres; on the Olympic, 784 acres; on the Snoqualmie, 700 acres; on the Madison, 657 acres; on the Ozark, 550 acres; on the Lolo, 337 acres; on the Pike, 271 acres; on the Cœur d'Alene, 191 acres; on the Helena, 175 acres; on the Sioux, 167 acres; and on the Wasatch, 109 acres.

Work of seeding and planting was done altogether on 106 of the National Forests. More than 16,000 pounds of tree seed were collected, and a total of 9,745 acres was sown and planted.

The planting stock on hand at the nurseries at the close of the fiscal year consisted of 18,907,276 seedlings and 2,002,358 transplants, of which 8,811,000 were Douglas fir, 7,676,000 western yellow pine, 618,000 jack pine, 1,105,000 Engelmann spruce, 467,000 Scotch pine, 367,000 Jeffrey pine, 333,000 eucalypts, and the remainder of some 20 other species. The problems connected with the best method of growing planting stock in large quantities are rapidly being solved, and there has been marked improvement in the Forest nursery work during the year all along the line.

The condition of the principal nurseries at the close of the fiscal year is shown below:

Principal nurseries on National Forests at the close of the fiscal year 1910.

Nursery.	Forest.	Present annual productive capacity.	Present stock.	
			Transplants.	Seedlings.
Los Prietos	Santa Barbara, Cal	300,000	79,660	52,500
Rocky Bayou	Choctawhatchee, Fla	50,000	10,720	.....
Pocatello	Pocatello, Idaho	1,600,000	95,000	2,072,000
Boulder	Helena, Mont	5,000,000	483,713	5,470,000
Savenac	Lolo, Mont	1,600,000	9,000	1,300,000
Trapper Creek	Bitterroot, Mont	1,000,000	300	207,000
Halsey	Nebraska, Nebr	250,000	190,054	1,348,240
Fort Bayard	Gila, N. Mex	550,000	114,634	258,520
Beaver Creek	Uinta, Utah	2,000,000	.....	834,720
Wasatch	Wasatch, Utah	2,500,000	331,400	4,530,000
Wind River	Columbia, Wash	1,050,000	.....	.....
Silverton	Snoqualmie, Wash	650,000	22,000	52,000
Total		16,550,000	1,336,471	16,924,980

In addition, experimental planting and sowing was done upon practically every Forest. Numerous species and methods were tried under some 600 separate experiments. The results of this experimental work have been of very great value, and while it must still be continued, and often increased, enough has now been learned to enable the undertaking of reforestation on a large scale, with definite knowledge as to what methods are adapted to the wide range of conditions to be met.

The seeding experiments included spring, summer, and autumn sowing broadcast by seed spots and by hand corn planters, both without preparation of the soil and with preparation by various

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methods. Numerous species were tried. The results were sufficiently satisfactory to warrant going ahead with this work on a much larger scale. The areas to be sown will be doubled next year if sufficient suitable seed can be obtained. In planting, many facts of local importance were discovered. Actual plantations were successfully established, some of them upon sites where it is extremely difficult to reestablish tree growth, and where sowing had proved or was certain to prove a failure.

In the practical work of planting it frequently becomes necessary to choose between two supplies of seed, both possibly from distant sources. Abundant seed years in some regions may be years of scant supply in other regions, and it is important to know whether the planting of seed matured in a totally different climate from that of their new environment is wise. To what extent the source of the seed may influence the success of the operation is a doubtful question. If it can be proved that climatic varieties within the species will adapt themselves readily to the new conditions, the problem of seed collecting will have been greatly simplified. If, however, trees grown from seed from a distant source prove susceptible to new climatic influences, the work of seed collecting must be more fully systematized. Another question needing investigation is whether it is poor policy to collect seed from unthrifty individual trees or from those which show poor form or a tendency to succumb to any unfavorable factors, lest such characteristics may be transmitted to the next generation of trees. Experiments are now being carried on to determine these points. A number of years will be necessary to secure final results.

Experiments with tree species not native to the region were also carried on. This introduction of so-called exotic species is of great importance in planting. It is quite possible that among the many exotic species available a few will prove equal or superior to the principal native species. Many parts of the West are entirely lacking in hardwoods beyond the few cottonwoods and willows which grow along the streams and the chaparral oaks. There is great need of a valuable hardwood, and there are apparently many situations where the soil is as good as would be demanded by any hardwood. The shortness of the growing season at altitudes where moisture is sufficient, the greatest impediment to exotic introduction, should not be an impassable obstacle if trees from northern latitudes are chosen. Wide latitude has been given experiments along this line.

To determine the relative vigor, drought resistance, hardiness, and growth rate of yellow pine, jack pine, and Scotch pine on a loose, sandy south slope in the Nebraska sandhills, such as are common throughout this region, 100 trees each of two-year-old seedlings which had been given one year in the transplant beds at the Halsey Nursery were planted. At the present time 85 per cent of the jack pine, 64 per cent of the yellow pine, and 34 per cent of the Scotch pine are growing. The remainder are either dead or rapidly failing. In order to determine the relative resistance to cold, exposure, and drought, and the rate of growth, of Austrian and yellow pine, 50 yellow pine transplants and 100 two-year-old Austrian pine seedlings grown in sandy soil at Charles City, Iowa, were planted. At the present time 100 per cent of the yellow pine are growing, but only 38 per cent of the Austrian pine are alive. In similar experiments with the Norway pine, but 22 per cent are now alive. These experiments are mentioned as single examples merely.

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Reforestation in Nebraska, owing to the sandy and dry conditions found there, has presented a very difficult problem. The results of the above and a large number of other experiments, however, demonstrate the possibility of planting in all situations in the sandhills with a fair degree of success. On south slopes it has been found that jack pine or Austrian pine is preferable, the former because of its rapid recovery after transplanting and the latter because of its great vitality and drought resistance. Scotch pine has done well on north slopes because of its lighter requirements for heat, and yellow pine has shown its adaptability to the bottoms and ridges where moisture conditions, though low, are uniform.

An exceedingly interesting experiment has been made in planting eucalypts in southern California on land which naturally supports only a dense growth of brush because of the limited supply of moisture. During the winter of 1908–9 nearly 45 acres on the Angeles National Forest, at an elevation of 1,200 feet, were planted to *Eucalyptus rostrata* (red gum), *E. robusta*, and *E. tereticornia*. In spite of the fact that on these chaparral-covered slopes the total annual precipitation is only about 7 inches, the planted eucalypts made a fairly rapid growth and withstood the exceptional drought of last summer. The importance of this experiment lies in the fact that eucalypts have hitherto been planted in southern California chiefly upon low-lying agricultural land, which could be irrigated and easily cultivated, so that the resulting product is rather an agricultural than a forest crop. If dry, brush-covered slopes at moderate elevations can be successfully planted, an important addition will have been made to the economic possibilities of the National Forests, and perhaps of other lands, in southern California. At present the chaparral plays an important part in the protection of the watersheds from erosion and in the water economy of southern California, but has practically no economic value in itself. Eucalyptus forests would protect the land at least as well as chaparral, and perhaps even better. Even though the planting of chaparral land to eucalypts by private individuals may never be profitable, the public value of protective forests added to the value of the timber, makes it of great moment to learn whether eucalypts can be made to replace chaparral.

The seed tests conducted during the winter of 1909–10 were: (1) Tests of methods of germination; (2) tests of seed samples collected on the National Forests in 1909 and sent to Washington for examination; and (3) germination tests of the samples placed in storage in March, 1909.

The tests of methods of germination gave inconclusive results. The tests of approximately 100 National Forest seed samples gave considerable material of scientific value. The germination tests of samples placed in storage in 1909 demonstrated that, for at least three tree species—Engelmann spruce, lodgepole pine, and Douglas fir—air-tight storage, in sealed glass jars, is much superior to any other method, no matter what the temperature of the place of storage, and that a room heated in winter is superior to an unheated room, doubtless owing to the greater dryness. It was also observed that the samples stored in regions of dry climate gave higher germinations than others.

Of great importance as a means of attacking the almost countless problems met with in Forest planting and Forest management are the

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Forest experiment stations. To the Coconino Station, previously established in District 3, there were added last year two new stations, the Fremont and the Wagon Wheel Gap. The Fremont Station, named in honor of Gen. John C. Fremont, is located about 4 miles from Pikes Peak, at about 8,850 feet elevation. The Forest range is here between 6,500 and 11,500 feet, and either extreme is within 4 miles of the station. A small nursery has been established to supply material for planting experiments. Such experiments were made with white pine, Scotch pine, and sugar maple on cool, moist situations, and with various other species. Collections including systematic and type herbaria, soil and rock, wood-destroying fungi, insects, rodents, etc., have been started.

The factors determining the occurrence of the various types in this region will be accurately determined. A study to determine the character and value of the factors which distinguish the yellow pine and Engelmann spruce types at an elevation of 8,900 feet and to measure those climatic and soil factors which determine growth, flowering, and seed bearing and those which may cause a pathological condition is under way. In cooperation with the Weather Bureau meteorological observations are carried on at the experiment stations. The necessary instruments have been loaned the Forest Service by the Weather Bureau. Accurate measurements on self-recording instruments of all weather factors are recorded, the measurements being taken on various slopes and aspects.

At the Coconino Experiment Station in Arizona the investigation of climatic conditions in an open park and surrounding timbered areas begun January 1, 1909, was continued. The results have an important bearing on the difficult problem of reproduction in the Southwest. They indicate that the forest exerts a very marked ameliorating influence upon extreme temperatures, wind movement, and evaporation. The most striking difference between forest and park conditions is in the minimum temperature, which on cold, clear nights was found to be as much as 23° F. lower in the park than in the forest. The enormous disparity between the park and forest temperatures has led to the suggestion that the difference may be mainly one of air drainage from the San Francisco peaks, the base of which lies within 4 miles of the station. In order to decide this, it will be necessary to carry on similar investigations in a locality removed from the immediate influence of high mountains.

At the same station considerable progress was made in experiments to determine by actual measurements the light requirements of species. These experiments are complicated by the influence of other factors on the growth of trees, which must be separated from the influence of light. To measure the variations of light requirement of the species it is necessary, first, to measure the light intensity in which it is found; second, to take observations on the response of plants in different light intensities; and, third, to measure as far as possible the other factors influencing growth, such as the temperature and humidity of the air and the temperature, moisture conditions, and quality of the soil.

Two permanent sample plots were established in 1909 in the western yellow-pine type of forest to secure light measurements and observe the development of seedlings from year to year. On each of these plots several light-measuring stations were selected in groups

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of seedlings in different light intensities varying from deep shade to almost full sunlight. Light readings were taken at each station hourly through the day on several clear days in July and October. The readings at all the stations were as nearly simultaneous as possible. Seedling counts are made at each station yearly in order to determine the rate of loss. Each count is accompanied by careful notes in regard to the condition of the seedlings and any possible disturbing factors. Periodic measurements of temperature, evaporation, and soil moisture are made at each station to ascertain any influence which might be due to these factors. It is known that yellow-pine seedlings in certain situations do not usually survive more than a few years, but it is not known whether their death is due to lack of light or to other causes, and it is just such problems which will be solved by the actual light-measurement experiments.

A detailed study of conditions under which reproduction of yellow pine takes place in the Southwest was completed on the Coconino Forest. The problem of securing natural reproduction of this species is the most important silvicultural problem of the region. The conclusions drawn from this study are as follows:

The climatic conditions in this region during the average year are extremely unfavorable to the establishment of seedlings. The greatest mortality results from drought and frost during the first season's growth. The effects of drought are more serious during and immediately before germination. Of the artificial factors affecting reproduction the most important are cutting, disposal of brush, grazing, and fire. Of these the most important factor is cutting. As a rule no reproduction can be expected after a heavy cutting. The cause of this is to be found not so much in the reduction of the seed supply as in the removal of the influence exercised by the forest upon physical conditions, especially temperature and evaporation. The first consideration in marking timber for cutting where reproduction is unsatisfactory should be to leave sufficient stand to secure the best possible forest conditions. Usually this provision will also insure a sufficient seed supply. Defective trees, whether "black jack" or old yellow pine, standing in a large opening should be left unless infested by insects or fungous diseases which would endanger the remaining stand. The number of yellow pine to be left must naturally vary with the character of the stand, exposure, and soil. In areas where there is a sufficient amount of immature growth to afford good wind protection only a sufficient number of yellow pine need be left to insure an adequate seed supply. From four to five seed trees per acre are sufficient. Sound, full-crowned trees standing in the more open situations make the best seed trees. Areas in which practically the whole stand is mature should be cut as lightly as possible, with the object of returning for a second cut as soon as reproduction has taken place. When natural conditions for reproduction are exceptionally unfavorable, as on deep cinder soils, exposed situations, and regions of low precipitation, it is necessary to leave a denser stand than where conditions are more favorable. Whenever possible, advantage should be taken of the fact that the greatest amount of reproduction usually starts under the immediate influence of the mother tree, where the light intensity is frequently too low for seedlings to develop normally in later life. An area on which a good crop of seedlings has sprung up beneath the trees should be

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logged if possible within two years after the seedlings start. There are certain areas on the Forest on which planting or broadcast sowing will probably be necessary. Under this class are included lands which have already been too heavily cut and certain lands on which satisfactory natural reproduction can not be obtained within a reasonable time even under the most careful management. Scattering brush after logging promises to aid natural reproduction materially by reducing evaporation and moderating the effect of frosts.

Reproduction suffers severely from sheep grazing. At present the only practical preventive measure for such damage seems to lie in the total exclusion of sheep from areas to be restocked, until the seedlings have grown out of danger. On an average, this will probably be about twenty years. Exclusion on areas to be logged should begin before the cutting.

Fires have done serious damage to reproduction in the past. Grazing decreases the danger from this cause by reducing the amount of inflammable material on the ground. In the future damage from fires will be largely eliminated.

As a means of learning the effect of different methods of cutting upon natural reproduction, cut-over areas in which there is already partial regeneration were studied. From such areas immediate results can be obtained; but because the old cuttings seldom followed distinct cutting systems, such as it is hoped to adopt in the future, it is necessary also to gather more perfect data by applying on small areas an ideal system of cutting. This was done in connection with a timber sale on the Cheyenne National Forest. Definite areas were laid out in a lodgepole pine forest, trees marked for cutting, and after their removal the brush on certain plots was lopped and evenly scattered, and on others piled and burned. On one plot approximately 50 per cent of the trees were cut, the selection being as nearly perfect as possible. All overmature trees and all suppressed trees were cut. In contrast with this method, on an adjacent area where the conditions were similar, openings of 30 to 40 feet in diameter were made by removing groups of overmature trees. These openings covered approximately 40 per cent of the area. Throughout the remainder of the stand only suppressed and defective trees were removed. Differences in reproduction in each of these two experiments are to be expected. The advantage of brush burning in inducing early reproduction as against the slower and less dense, but perhaps more thrifty reproduction of the unburned area, will be carefully noted. Under the first system a considerable amount of reproduction should gradually appear before the next cutting. Under the group system the openings should reproduce rapidly, especially where brush has been burned. Similar experiments have been started in Engelmann-balsam stands and also in yellow pine forests.

STREAMFLOW STUDIES.

To determine exactly what effects the forest cover may have upon the disposition of rain and snow water, its run-off, storage, and later appearance in springs, and the possibility of erosion and silting up of streams, an experiment station has been started at Wagon Wheel Gap, on the Rio Grande National Forest. Two similar watersheds were found, of approximately 200 acres each, emptying into the valley of

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the Rio Grande at a point about 1 mile above Wagon Wheel Gap. The head of each stream is at an elevation of about 10,500 feet and the mouth at an elevation of 8,700 feet; the length of each stream is approximately 1 mile. A concrete dam and settling basin have been built in each stream at an elevation of about 9,500 feet, and each is equipped with an automatic river-stage register recording the height of the stream over a weir. Accurate measurements of the precipitation at various points on each watershed will be recorded and other meteorological observations taken. Both watersheds are now almost completely forested, with good cover conditions. During the first two years of the experiment the flow of the two streams will be continually measured with the cover conditions as they are now. During both this and the succeeding period all climatic factors which may in any way help to explain the behavior of each stream at stated times will be measured. The fall, melting, and evaporation of snow will also be carefully studied. After two years, the relative character and amount of flow from the two watersheds having been learned, one of the watersheds will be entirely denuded of forest cover, and also burned over. The behavior of the streams under these conditions will be studied during the period of denudation, formation of sod, period of overgrazing, and perhaps during reversion to forest.

OTHER STUDIES.

Experiments have also been carried on in thinnings in order to determine the increased rate of growth and whether a better quality of timber is produced. Plots 50 by 100 feet have been laid out on a steep south slope with good sandy loam soil in the Black Hills National Forest. The plots were thinned to a spacing of about $5\frac{1}{2}$, $3\frac{3}{4}$, and $4\frac{3}{4}$ feet, respectively. All the remaining trees were numbered and measured for actual height to the nearest foot and diameter to the nearest tenth of an inch. Future measurements at intervals of about five years will determine the rate of growth. Similar experiments have been started in lodgepole pine, Engelmann spruce, and balsam fir, and on other Forests.

The beginning made in 1909 and the year before in reconnaissance studies on National Forests was carried forward more extensively. These timber estimates and studies are made for the purpose of ascertaining the resources of the Forests and are used as a basis for outlining a plan for their future management. The data gathered cover chiefly the amount, quality, character, and location of standing timber, the rate of growth of the different species, the most desirable location for sales, and the logging methods which should be used. Bodies of timber which should be removed for the good of the Forest are located and recommendations made for their sale. Fire-killed areas and insect infestations and other causes of injury to the Forest are noted. When the work is completed for any Forest there are on hand reliable estimates of the timber by sections, definitely formulated knowledge as to where, at what price, under what logging methods, and under what restrictions timber can be advantageously sold, timber maps, and in general full details needed for careful and intelligent management.

In addition to the reconnaissance mentioned in last year's report, which involved the cruising of over 2,000,000 acres of timberland,

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work was commenced this year on the following National Forests: Arkansas, Battlement, Cascade, Choctawhatchee, Cochetopa, Coeur d'Alene, Crater, Gila, Helena, Kaibab, Kaniksu, Leadville, Manti, Medicine Bow, Minidoka, Olympic, Oregon, Pend Oreille, Pocatello, Rio Grande, Routt, Salmon, San Isabel, San Juan, Sawtooth, Sioux, Snoqualmie, Targhee, Umpqua, and White River. The total area of timber cruised during the year aggregates 3,021,000 acres.

In addition to the above more or less intensive reconnaissance work, preliminary reconnaissance work was done upon over 8,000,000 acres, principally on the Pacific slope, with the object of getting a rough approximation of the quantity of timber in some of the more important lumbering districts. This taking stock of the timber resources of the Forests, classifying the types of timber, and outlining methods of management is one of the most important pieces of work now confronting the Service and is being pushed forward as vigorously as possible.

Investigations of insect infestations and diseases of forest trees were carried on, as in previous years, in cooperation with the Bureau of Entomology and the Bureau of Plant Industry. Work was done in controlling insect depredations on a number of Forests. On the San Isabel Forest, in Colorado, by cutting and peeling 795 trees, at a cost of 69 cents per tree, the number of newly infested trees was reduced to 6 or 7, as against over 1,000 last year. A scattered infestation discovered on the Las Animas National Forest was left to run itself out. One on the White River National Forest was successfully combated. The extensive insect ravages in the Black Hills, where millions of feet of standing timber have been killed in the last ten years, are at last well under control. An area of over 500,000 acres of infested timber was discovered in and adjacent to the Wallowa and Whitman Forests in Oregon; it is proposed to combat these insects under the advice of the Bureau of Entomology and in cooperation with the Land Office, state officials, and private interests concerned. The area infested is extending at a rapid rate, and unless the insects are checked many million dollars' worth of valuable yellow-pine timber will be killed.

RANGE MANAGEMENT.

During the year the benefits of proper range control, the aims of National Forest administration, and the ultimate effect of this administration upon the range live-stock industry were increasingly realized by stockmen who use the Forests. Cooperation between the Forest Service and the stock growers, both in the administration of the grazing business and in range-improvement work, has become wider. The efforts of the Forest Service to enforce federal and state quarantine regulations within the National Forests, to lessen losses of stock by destroying predaceous animals, and to restore depleted ranges by developing improved methods of range control, by artificial reseeding, and by the eradication of range-destroying animals have all met with hearty approval. The favorable action taken upon all reasonable requests for changes in local grazing administrations, when expressed through the advisory boards of properly organized associations of permittees, has given a new impetus to the formation of such organizations and has demonstrated that the ranges within the National Forests are handled in the interest of the welfare of local settlers and of securing the maximum use of the forage-producing lands.

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GRAZING CAPACITY OF NATIONAL FORESTS.

Of the 146 National Forests in the United States exclusive of Alaska on June 30, 1910, 6 afford no grazing for domestic animals. The remaining 140 Forests were under grazing administration. Certain of the Forests in northern Washington, northern and central Idaho, and northern Montana are not fully stocked, principally because the unused ranges are more or less inaccessible and are remote from railroad shipping points and from spring, fall, and winter ranges. This condition is, however, a passing one, and the construction of new railroads, the granting of feed-in-transit rates by existing railroads, and the building of necessary trails and sheep driveways by the Forest Service will within a short time bring complete utilization of these ranges. Elsewhere the National Forests are fully stocked, and in many parts of the West the demand for grazing privileges is far beyond the supply.

The eliminations effective or proposed up to June 30, 1910, materially reduced the grazing area on the Forests. The lands excluded were chiefly lowlands of more than average forage-producing capacity, which were fully stocked, principally by cattle and horses. On eliminations approved by the Forester before the grazing season opened grazing was allowed without charge and without permit pending the issuance of the presidential proclamation. A number of choice lambing grounds upon which permittees had previously depended were eliminated. Inevitably the grazing receipts fell.

The Crow Creek division of the Cheyenne National Forest was on April 19, 1910, transferred by executive order to the jurisdiction of the War Department. At the request of the Secretary of War the Forest Service continues to exercise supervision over this area pending the time when the War Department is ready to assume full charge of it.

RANGE CONDITIONS.

The range conditions in all six districts were markedly similar. In the fall of 1909 frequent and timely rains resulted in an unusually abundant growth of forage upon all of the Forests. The ranges were well seeded, while stock left the Forests in good condition and commanded good market prices, although the market for wool was not so strong as it had been in previous seasons.

The winter of 1909–10 was a severe one upon stock growers generally. Many permittees reported it the hardest winter in twenty years. Prolonged periods of extremely cold weather caused suffering among all classes of stock; winter losses were above the average, and the percentage of increase among sheep and cattle was materially reduced. The snowfall was less than usual.

The spring of 1910 was from a month to six weeks early, and ranges were free from snow and ready for use that much sooner. The warm growing weather and the melting of snow started the forage growth under exceptionally favorable conditions. The stock entered the Forests in good condition. But there were almost no spring rains. The rapidly maturing forage dried up, and water grew scarce. Upon many Forests the last quarter of the fiscal year was a period of almost absolute drought; upon the majority, however, light rains at infrequent intervals brought some relief. At the close of the fiscal year stockmen generally were anticipating a prolonged drought. The sit-

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uation on the summer ranges was less serious than on the fall and winter ranges, where the feed had made little if any growth and in many sections was not likely to make much before the close of the growing periods.

The National Forest cattle industry suffered little. Cattle generally were in good condition at the close of the year, though there was a shortage of calves in consequence of the severe winter. Sheep interests were much more seriously affected. The lamb crop was very short. The number of grass-finished lambs turned off of the National Forest ranges will be much below normal, and a much larger percentage will be sold as feeders or carried over until next year. Prices for cattle grazed within the Forests remained fairly strong, but prices for wool and mutton fell off.

Under the system of range control applied to the National Forests the conditions, though unsatisfactory, were vastly superior to those upon adjacent public lands. In a number of instances stock on the ranges for a time was replaced by other stock from outside ranges, thus conditioning a double amount. Requests for admission to the National Forests from persons not previously occupying them were numerous, and were granted whenever possible without injuring other permittees or forest interests. Many areas hitherto considered inaccessible were brought into use, and every effort was made to provide range. Approximately 100,000 head of sheep were thus tided over the emergency caused by abnormal conditions.

With three or four notable exceptions in the States of Utah and Oregon, grazing conditions are so well settled upon the National Forests that few reductions in the total number of stock allowed need be anticipated, though the recognition of new settlers in or adjacent to the Forests will entail limited reductions for some individual permittees. No large areas have been closed to grazing during the year, and no condition has arisen which will require the exclusion of all classes of stock from any considerable area of Forest land during the coming year.

IMPORTANT CHANGES IN LIVE-STOCK INDUSTRY.

There is at present an evident inclination among many National Forest stock growers to raise sheep instead of cattle. This is especially noticeable in the Northwestern States, but is not confined to them. The tendency to change is not due to the system of grazing control, but to the greater present profits of the sheep business and to the greater success of the sheep interests in the competition for the use of uncontrolled public lands. In most instances, and wherever changes could be allowed without injury to forest interests, damage to important watersheds, or injustice to other permittees, requests for changes in classes of stock have been granted.

GRAZING TRESPASS

The published reports of the decision of the Supreme Court of the United States in two grazing trespass cases in California caused a widespread impression that the regulations of the Secretary of Agriculture were not enforceable, and in some States there was a pronounced inclination to attempt to graze stock on the Forests without permit. The definite announcement that the regulations would con-

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tinue effective and would be vigorously enforced pending a final decision, followed by the granting of a request for a rehearing of the cases by the Supreme Court, restrained any general movement to willful trespass; but in a number of cases it was necessary to protect the Forests by injunction proceedings. Criminal action on willful grazing trespass has been and will be deferred until this decision is rendered.

There were 342 cases of grazing trespass during the year, and 42 cases were pending at the beginning of the year. Of this number 56 were dismissed by the Forest Service, 9 were prosecuted in the courts, 203 were adjusted upon the payment of damages, and 116 were pending at the close of the year, a majority of them having occurred too late for adjustment.

ADVISORY BOARDS.

Ten new advisory boards of local organizations of stock growers were recognized. Fifty-six advisory boards are now recognized and very effectively cooperating with the Forest Service. The men selected to represent them in their dealings with the Forest Service have been uniformly of a high standard of efficiency and experience, and in the majority of cases their recommendations have been disinterested and impersonal to a degree. The District Foresters have found their cooperation very valuable. Many stockmen have criticised the grazing administration as arbitrary, for upon Forests where there is no organization of local stockmen the conflicting demands of several hundred permittees often necessitate decisions which to a large minority appear radical or arbitrary. Where advisory boards are recognized the stockmen themselves help settle such questions. The boards receive advance notice of any proposed changes in administration, and their recommendations are, so far as possible, carried out. In late years no one factor has contributed more to good grazing administration than the advisory boards.

PERMITS.

Paid grazing permits were issued as follows:

State or Territory.	Cattle, horses, and hogs.				Sheep and goats.		
	Permits issued.	Cattle.	Horses.	Hogs.	Permits issued.	Sheep.	Goats.
Arizona	1,659	224,895	9,709	618	187	427,042	12,045
Arkansas	19	394	1	46	.....	.....	.....
California	2,577	162,433	8,587	1,667	301	382,715	15,309
Colorado	2,650	236,596	7,542	.....	353	594,847	3,460
Florida	33	827	.....	115	7	563	.....
Idaho	1,959	111,017	8,960	.....	829	1,811,147	.....
Kansas	84	10,448	161	.....	1	420	.....
Montana	1,903	133,597	14,156	.....	252	576,971	915
Nebraska	80	38,714	1,231	.....	.....	.....	.....
Nevada	371	52,121	5,373	.....	79	441,592	900
New Mexico	2,012	110,031	6,658	351	673	504,112	56,249
North Dakota	6	305	10	.....	.....	.....	.....
Oklahoma	31	4,741	208	.....	.....	.....	.....
Oregon	1,423	114,084	9,570	348	594	959,920	222
South Dakota	519	11,956	1,158	.....	.....	.....	.....
Utah	4,455	115,336	7,310	.....	1,323	895,395	900
Washington	260	9,352	856	.....	100	165,079	.....
Wyoming	651	73,026	3,062	.....	296	798,847	300
Total	20,692	1,409,873	84,552	3,145	4,995	7,558,650	90,300

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The table shows a decrease from the previous year of 81,512 cattle, 5,467 horses, 1,356 hogs, 121,048 sheep, and 49,596 goats, or a falling off of 2.75 per cent in the total of all kinds of animals grazed under permit. This falling off was due primarily to the decrease in the grazing area because of eliminations either made or contemplated. The area thus opened to free grazing was about 1.55 per cent of the total area on which grazing permits were required in 1909. That the percentage of decrease in animals grazed should exceed the percentage of land withdrawn from grazing control followed naturally from the fact that the lands selected for elimination were along the exterior boundaries of the Forests. In proportion to their area these relatively low-lying and open-timbered or nontimbered lands are above the average of National Forest land in their carrying capacity, while they are also accessible to near-by settlers who graze small quantities of stock near home, but do not drive stock into the higher and more remote parts of the Forest. In other words, the grazing on these lands was in exceptional demand, and in demand especially by small users. It is, therefore, not strange that the number of grazing permittees using the Forests decreased by 5.7 per cent. The decrease in the number of permittees for grazing cattle, horses, and hogs was 6.6 per cent, and for grazing sheep and goats 1.6 per cent. The average amount of stock grazed by each permittee remained practically the same as in the previous year—72 cattle and horses and 1,531 sheep and goats to each permit in 1910, as against 71 and 1,541 in 1909.

The percentage of approved applicants who failed to pay the grazing fees and utilize their privileges was 7.8 per cent, as against 7 per cent for the previous year.

The practice of issuing free permits under special fire-fighting agreements on the Arkansas and Ozark Forests in the State of Arkansas was abandoned, but the special exemption limits are still maintained and the number of stock grazed was practically the same as during the preceding year.

The receipts for grazing fees paid on account of the above permits are stated on page 10. They show a decrease of $45,276.32 from the preceding year.

The plan to allot grazing privileges for periods of five years was extended to 9 additional Forests during the year, and is now effective upon 35 Forests. Its success is beyond question, and it has received the strong approval of the permittees. The general application of this system will, however, be deferred until an equitable adjustment of all conflicting interests, satisfactory divisions of the range, and reliable estimates of the carrying capacity of the Forests have been secured under the District organization.

There were issued 2,615 crossing permits, for which no charge is made. These permits allowed 77,507 head of cattle, horses, and hogs and 4,944,401 head of sheep and goats to be driven to private lands within the Forests or across the Forests to outside ranges or shipping points, an increase in permits of 24 per cent and in stock of 21.5 per cent. No permits were required for small bands of stock which were driven along public highways, or for stock which was not grazed upon Forest lands en route. There was practically no delay in the movement of stock and no embarrassment to stock growers

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because of the requirement of these permits, while Forest interests were carefully protected. There was little, if any, abuse of the crossing privilege.

Permits issued for the construction and maintenance of range improvements increased materially in number. These permits are divided into two classes: Free permits, covering all constructions which benefit others as well as the permittees, such as drift fences, corrals, water tanks, stock trails, etc.; and charge permits, involving the exclusive occupancy of land for pastures, dipping vats, shearing pens, slaughterhouses, private stock reservoirs, etc. There were issued 720 free permits, allowing the use of 4,204 acres of Forest land and the construction of 692 miles of drift fence, pipe line, and stock trails. At the close of the year 1,621 free permits were in force, involving 7,011 acres of land and 1,586 miles of drift fences, pipe line, and trails. The charge permits issued numbered 1,139, and allowed the use of 162,540 acres of land. The charge permits in force at the close of the year numbered 2,274, and covered 428,744 acres.

On several National Forests boundary fences, which had been erected in previous years by stockmen in cooperation with the Forest Service to stop the drifting of cattle to and from the adjoining ranges, seemed about to become, in consequence of proposed eliminations, illegal fences upon the public domain. To allow a reasonable time for the removal of these fences, it was agreed between the Secretary of Agriculture and the Secretary of the Interior that the eliminations shall not become effective until early in 1911. Where permits had been issued allowing special uses of land now eliminated or to be eliminated from the Forests, the Department of the Interior will carry out the terms of the agreement made by the Forest Service, so far as is possible under the law.

USE OF STATE LANDS.

The cooperative agreement between the Forest Service and the State of Utah mentioned in former reports was abrogated January 1, 1910, by mutual consent. Under the agreement the State received for stock grazed on state lands within the Forests the same fees charged by the Service on National Forest lands, except that a part of the fees went to pay the cost of administration by the Forest Service. The land commissioners of the State were not satisfied with the revenue thus yielded. Since the termination of the agreement the lands belonging to the State have been leased to the highest bidder, with a considerable increase in revenue. Many persons were outbid for the use of ranges upon which they had depended for a number of years. In many cases it was impossible to provide them with adequate ranges upon Forest lands without hardship to other permittees.

The agreement with the State of South Dakota was terminated for the same reason. The grazing use of the South Dakota lands was not as intensive as in Utah, and no embarrassment resulted from the cancellation of the agreement.

No new cooperative agreements for the administration of state lands were entered into during the year.

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USE OF PRIVATE LANDS.

Owners or lessees of private grazing lands within National Forests may either retain the exclusive use of such lands, taking out a free crossing permit if the stock is to be grazed on Forest land en route and, if the private land is unfenced, so handling the stock that it will not encroach upon Forest lands, or waive the right of exclusive use and secure in return a free permit for the number of stock which the private lands will support under the regulations of the Secretary. This enables the owners or lessees of private lands to completely utilize their holdings at least cost, while other permittees are not forced to keep their stock from trespassing upon the patented lands, which in a number of States necessitates the payment of damages to the owner of the land. Of such permits 1,316 were issued, covering 54,465 cattle and horses and 375,214 sheep and goats, in exchange for the right to graze 2,158,610 acres of land. This was an increase in the number of permits of 13.7 per cent, in cattle and horses of 4.25 per cent, in sheep and goats of 27 per cent, and in acreage of 42.7 per cent.

The cooperative agreement with the Atchison, Topeka and Santa Fe Railroad Company was continued. Under this agreement pay permits for three-fourths of the number of stock which the railroad lands within the Zuñi National Forest will support are issued by the Forest Service, to cover the pro rata cost of administration of the railroad lands. The remaining one-fourth represents the railroad company's net quota and is covered by special permits issued upon certificates from the land commissioner of the company. Forty such permits allowed the grazing of 262 cattle and horses and 6,762 sheep and goats.

Upon the Palouse district of the Coeur d'Alene National Forest the administration of the Forest lands was seriously complicated by the fact that 94,000 acres of state and private land was distributed throughout the district. An agreement was accordingly entered into with the Northern Idaho Forestry Association, representing the State and private owners, under which 14 permits were issued covering 277 head of cattle and horses and 11,782 head of sheep.

The Weyerhaeuser Land Company and the Northern Pacific Railroad Company cooperate informally with the Forest Service by leasing their lands in the Fremont and Wenatchee National Forests to persons, preferably Forest Service permittees, who will waive the right of exclusive use in exchange for free grazing permits under Regulation 65.

PROTECTION AGAINST DISEASE.

The efforts to free the National Forests from all forms of communicable disease injurious to live stock have been extremely successful. This has been mainly due to the energetic and effective assistance of the Bureau of Animal Industry, which in cooperation with the Service has steadily reduced the area of Forest land upon which such diseases are prevalent. The National Forests are now, except in a few isolated instances, free from all forms of stock disease, but they can be kept so only by active cooperation with the

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Bureau of Animal Industry while disease exists upon outside ranges occupied for a part of the year by permitted stock. The Bureau of Animal Industry makes a rigid inspection of exposed stock before its admission to Forest ranges, while the Forest Service requires all permittees to submit to such inspection and show a certificate of freedom of their stock from disease before it is allowed to enter a Forest.

Inspection of sheep against scab was necessary only upon certain Forests in Colorado, California, Nevada, Utah, Arizona, and New Mexico, and in general the Forests are becoming free from scab. The lip and leg disease threatened to become epidemic in the State of Wyoming during the spring. Inspection by the Bureau of Animal Industry of all sheep using National Forest ranges within that State, except in Fremont County, was required. The Forest lands were thus kept free from contagion.

The Texas fever tick now occurs only on the Cleveland National Forest in California, the Wichita National Forest in Oklahoma, and the Arkansas and Ozark National Forests in Arkansas. On the Cleveland Forest it is confined to a small area along the international boundary line. A fence along the boundary which will be constructed by the Bureau of Animal Industry, to prevent the intrusion of tick-infested cattle from the Mexican side, will assist in eradication of the tick and prevent reinfestation. The Wichita Forest has been found to be seriously infected. Although it lies south of the Bureau of Animal Industry's quarantine line, it has been deemed best to take active steps to eradicate the tick. This will necessitate the abandonment of parts of the Forest for grazing purposes for one or more years. Upon the Arkansas and Ozark Forests the presence of the fever tick has not only reduced the grazing value of the Forest lands, but also seriously complicated the administration of the Forests, because of current local belief that the tick can be controlled by burning the land over each year. The Bureau of Animal Industry holds that such burning of the woods does not exterminate the tick or prevent its spread, and has taken such steps as lay within its power to counteract the wrong belief to the contrary.

The demand of Forest users for blackleg vaccine was about the same as in 1909. Use of the vaccine, which is furnished by the Bureau of Animal Industry upon the recommendation of the Forest Service, has materially reduced the loss of National Forest stock through blackleg.

By enforcing State quarantine regulations, the Forest Service has worked in harmony with the stock sanitary boards of the different National Forest States.

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PROTECTION AGAINST WILD ANIMALS.

Forest officers killed the following animals harmful to livestock and to game animals and birds:

Wild animals destroyed.

State or Territory.	Bears.		Mountain lions.		Wolves.		Wolf pups.		Coyotes.		Wild-cats.		Lynxes.		Total.	
	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.
Arizona	5	16	56	41	2	12	.....	.....	256	273	192	114	.....	56	511	512
California	31	73	8	23	1	2	.....	.....	202	903	38	309	.....	37	280	1,347
Colorado	.....	12	3	3	1	6	.....	11	73	613	11	88	1	3	89	736
Idaho	16	31	.....	10	19	30	3	.....	1,178	1,177	84	90	13	3	1,313	1,341
Minnesota	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2
Montana	21	35	.....	7	44	38	41	105	491	459	68	33	35	10	700	687
Nebraska	.....	.....	.....	.....	.....	.....	.....	.....	.....	30	.....	.....	.....	.....	.....	30
Nevada	.....	.....	.....	.....	.....	.....	.....	.....	45	39	14	3	1	2	60	44
New Mexico	14	9	28	6	64	24	7	.....	322	1,238	116	104	30	6	581	1,387
Oklahoma	.....	.....	.....	.....	.....	.....	.....	.....	.....	27	.....	14	.....	.....	.....	41
Oregon	8	47	.....	1	8	6	.....	6	246	960	11	64	.....	.....	273	1,084
Utah	8	.....	1	1	.....	2	.....	.....	331	1,185	37	292	1	.....	378	1,480
Washington	3	38	.....	6	.....	1	.....	.....	8	11	.....	35	.....	12	11	103
Wyoming	2	8	.....	.....	5	8	11	26	143	242	.....	23	.....	2	161	309
Total	108	271	96	98	144	129	62	148	3,295	7,157	571	1,169	81	131	4,357	9,103

This is an increase of 109 per cent over the number of animals destroyed last year. The number of bears killed increased 151 per cent, of wolf pups 139 per cent, and of coyotes 107 per cent. Wolves and coyotes are particularly destructive animals. The benefits of this work are cumulative, for the animals killed off cease to breed as well as to levy toll upon the stock and game on which they feed.

Good progress was made in clearing parts of the range of prairie dogs. Many of the Forest officers have become proficient in the methods found to be most successful. This work was carried on as widely as possible with the funds available. Stockmen displayed an active interest in the work, and in a number of instances cooperated with the local Forest officers.

PROTECTION AGAINST POISONOUS PLANTS.

Much smaller losses of stock through poisonous plants were reported than in former years. This is believed to be due to the cooperative work conducted by the Forest Service and the Bureau of Plant Industry to determine the character and location of the plants which have caused the heaviest losses, and to recommend means of prevention and cure. These means were chiefly the adoption of better methods of range control and fencing of the most dangerous areas. Further investigations were made by the Bureau of Plant Industry of a few cases of poisoning mentioned by supervisors in their annual grazing reports, and the investigations of the previous year at the experiment station on the Gunnison National Forest were continued, special attention being given to the different varieties of larkspur and loco weed. Stockmen have displayed a great interest in this work.

FORAGE AND PASTURE INVESTIGATIONS.

The most noteworthy investigation initiated was a system of grazing reconnaissance, which will ultimately be applied to all National Forests. This reconnaissance is planned to determine the

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character of all land within the Forests, the class of stock to which each natural grazing unit is best adapted, the natural periods of use for grazing purposes, the undergrazed, fully grazed, and overstocked ranges, the areas upon which poisonous plants abound, and the areas infested with range-destroying rodents. Such a reconnaisance of a Forest, when completed, will furnish a reliable basis for the preparation of a grazing working plan, which will be used as a guide in the allotment of grazing privileges, the determination of improved methods of range control, and the improvement of the ranges. The work was begun last spring. The results hitherto obtained are incomplete, but are very valuable. The season's experience will make it possible to continue the work under a better plan and with broadened scope. A reconnaissance of this character is essential to a systematic administration of the grazing business.

Artificial reseeding operations were conducted on a considerable number of Forests, but were confined principally to inclosed areas, such as ranger pastures and other administrative sites, where the experiments could receive careful attention, and where the results would have a practical as well as an experimental value. The severe drought which prevailed during the spring was highly unfavorable to germination and growth. The few experimental reseedings of open ranges were unsuccessful for the same reason. The chief lesson taught by the experiments seems to be that fall sowing will give a greater probability of success.

The investigations of methods of natural reseeding have progressed along satisfactory lines. The study which has been conducted during the past three years to determine the best methods for revegetating high ranges upon which mountain bunch grass naturally predominates was continued. In general, the investigations have demonstrated conclusively that by proper rotation in the use of grazing lands it is possible to secure a thorough natural reseeding of certain classes of land at adequate intervals, without any serious decrease in the amount of forage produced. To fix the proper periods of rotation for different localities will require considerable technical investigation.

The pasture experiment which for three years past has been conducted upon the Wallowa National Forest was continued during 1910 along new lines. Detailed observations are made only at the beginning and close of the field season. During the remainder of the time the sheep will be under the care of the regular herder, who will collect simple data regarding their movements and will patrol the fence every second day. It is probable that the experiment will be concluded at the close of the present field season. The results of this experiment have awakened widespread interest among sheep growers. Several sheepmen who constructed similar pastures because of the showing made report that the ventures have proved very profitable, while a number of applications have been received for permits to erect similar inclosures upon other Forest lands, either independently or in cooperation with the Forest Service. These latter have been rejected because of the inadvisability of hampering the administration of the Forests by leasing large areas of Forest land, and because the success of the system on all classes of range has not been definitely established. The primary objects of the experiments have been accomplished, since it has been demonstrated that the grazing capacity of certain classes of Forest lands

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can be largely increased by improved methods of handling stock, and that the increased cost of such methods, if any, is offset by increases in number and weight of lambs raised, heavier wool crops, and reduced losses from predatory animals.

During the spring of 1910 a series of experiments to determine the feasibility of lambing sheep in small inclosures was initiated upon the Cochetopa Forest, in Colorado. The areas upon which sheep may be successfully lambed are limited in number and in great demand, and under existing methods lambing on the range is unusually injurious to the area used, losses are large, and the operation is expensive. The primary object of the experiment is to find a method by which sheep may be lambed upon small areas with a maximum percentage of increase, a minimum cost, and a minimum of damage to the Forest lands. The construction of the inclosures was scarcely completed at the close of the fiscal year, and the observations were limited; but the experiment will be continued until definite results are secured. This work is being watched with strong interest by the sheepmen, for a successful solution of the problem will be of inestimable value to the woolgrowers who have to depend upon the National Forests for their spring and fall ranges. As the inclosures used by one permittee will seldom aggregate 160 acres, there will be no administrative objection to a widespread application of the principle if it proves successful.

In connection with the pasturage and lambing experiments, a number of observations were made at pastures owned and operated by private persons, and data of considerable value were secured.

The logical extension of the pasturage experiment will be its application to spring and fall or yearlong ranges upon some of the southern National Forests where the use of Forest land for grazing purposes extends over longer periods. It is hoped that a study of this character may be inaugurated, but this may prove impossible unless additional men of technical training can be secured to make the necessary observations.

An experimental test of the use of goats as a means of preventing the accumulation of inflammable material upon fire lines and as a means of opening up areas densely covered with brush as a preliminary to reseeding operations was conducted during the year on the Lassen National Forest, in the State of California. The result of this test, while not wholly satisfactory, has been fair and warrants the continuance of the experiment. A number of small patches of brush have been killed out, and it has been determined that certain species of brush may be readily suppressed or killed by goats. The only serious drawback encountered is that after the ground feed has been consumed the goats do not thrive as well upon an exclusive diet of brush as they do upon the mixed feed afforded by more open grazing lands. The experiment will be continued until definite results have been secured.

GAME PRESERVES

The Wichita and Grand Canyon National Game Preserves are both located within National Forests, and as in previous years were under the administration of the Forest Service. By proper restriction of grazing, by the extermination of predaceous animals destructive to

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game animals and birds, and by a thorough patrol which protected them from slaughter or molestation, increases in the numbers of game animals have been brought about. Upon the Grand Canyon Preserve the deer have multiplied beyond all expectation, and the buffalo herd on the Wichita Game Preserve is in excellent condition, while there has been a marked improvement among other classes of animals and birds.

During the year the Forest Service cooperated with the Biological Survey to secure data as to the geographical distribution of game animals and birds upon the National Forests of the United States, and with the State of Washington to secure more detailed information, as a basis for recommendations for changes in the game laws of the State concerning the game animals upon National Forests in that State.

PERMANENT IMPROVEMENTS.

The construction work of the year comprised 2,225 miles of trails, 320 miles of roads, 1,888 miles of telephone lines, 65 bridges, 563 miles of fences, 181 miles of fire lines, 464 cabins and barns, and 51 corrals. This was an increase of 25 per cent over the previous year in the mileage of lines of communication and protection constructed, and a reduction in the number of buildings of 20 per cent and in miles of fences of 28 per cent. Nearly 10 per cent of the whole amount appropriated for permanent improvements went into repairing damages to existing roads, trails, and telephone lines, which suffer heavily in the winter storms.

The appropriation for permanent improvements on the National Forests was $600,000. For the fiscal year 1911, however, the amount available for this work is only $275,000. While it is impossible to equip the Forests offhand, by the expenditure of a great sum, with a thoroughly well-planned and effective equipment of the various kinds of permanent improvements needed, a much larger amount than is now available could be used to advantage in carrying out plans already matured for such equipment. In order to prevent haphazard work under a piecemeal method, an improvement plan has been made for each Forest under which the work presumably to be carried on through a series of years may be properly coordinated to the end that the Forest may eventually be supplied with an adequate, coherent, and unified system of communications, stations, fire lines, stock fences, and other aids to protection and use of all the resources of the Forest.

These plans contemplate what may be called the primary system of improvements. Subsequently these improvements will be required to be supplemented by the development of a secondary system to provide for intensive use of all parts of the Forests. The development of the secondary system will take place naturally as the development of each locality in population and wealth calls for it, and in some Forests it will not be called for at all until after it has reached an advanced stage elsewhere. The primary system, however, is called for on all Forests just as rapidly as it can be supplied. The plans now prepared for the individual Forests call for the building of over 30,000 miles of trails and nearly 7,000 miles of roads, at an estimated cost of over $3,000,000; of over 16,000 miles of telephone lines, at an estimated cost of nearly $1,000,000; of over 5,000 miles of fences, at an

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estimated cost of nearly $600,000; and of other permanent improvements, including rangers' quarters, of over $1,000,000. With the further amounts needed for fire lines, bridges, watch towers, tool stations, and other purposes, the cost of the present estimated needs of the Forests reaches a total of over $7,800,000. The importance of the permanent improvement work as a part of the organized fire protection has already been discussed on pages 18 and 19.

By cooperation with States, communities, associations, and individuals in equipping the Forests with facilities of benefit both to the Service and to the cooperators many needed improvements were secured at a low cost. On the Cleveland National Forest a road 16 miles long was built at a total cost of $18,134.66; the Forest Service contributed $2,134.66. To the Libby Creek wagon road, on the Kootenai Forest, built in cooperation with mine owners at a cost of $5,000, the Service contributed $500. A road built on the La Sal Forest in cooperation with the county and with private subscribers cost the Service $150, with a total outlay of $1,820. On the Manti Forest $331.75 was contributed toward the building of a road in cooperation with the people of Emery and Ferron, Utah, which cost $2,117.65. In many other cases roads, trails, telephone lines, drift fences, pastures, corrals, and miscellaneous improvements were provided at a cost to the Forest Service of but 10 to 20 per cent of the total.

In inhabited regions within the Forests the development both of the country and of the highest usefulness of the Forests is promoted by such cooperative work. Only a small part, however, of the permanent improvement fund could be allotted to such work, since the character of most of the country included within the National Forests is such that facilities to enable the Forest officers to reach the more inaccessible parts quickly when fires occur must be the first consideration.

FEDERAL COOPERATION

In cooperation with the War Department examinations were made of trees and timber and plans prepared for forest management or timber sales supervised at Forts Huachuca, Sheridan, Slocum, and Wingate military reservations, and at the Augusta, Frankfort, Watertown, and Watervliet arsenals. Cooperative experimental planting work also was done with the War Department at the Saunderstown Military Reservation, near Newport, R. I.

For the Interior Department an examination was made of forest conditions on the Hot Springs Reservation, and certain timber in the Yosemite National Park was estimated. With the exception of the Menominee Reservation, where the Forest Service is required by law to designate for cutting the fully matured and ripened green timber, no cooperative timber work has been conducted on Indian reservations since the termination of the cooperative agreement at the beginning of this fiscal year.

STATE AND PRIVATE COOPERATION

Besides administering the National Forests it is also the duty of the Service to promote forestry throughout the country. It does this chiefly by cooperating with States and private owners.

The policy of the Service in cooperative work follows three distinct lines: (1) Advising States which ask for aid in the formulation of a

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forest policy, (2) assisting them to determine the extent and value of their forest resources, and (3) assisting private owners in the practical application of forestry to their lands. All cooperative work is done at the request of States or private owners, and they always share in its expense. The assistance given is educational as well as advisory, and the putting of the recommendations into effect rests entirely with the State or the private owner.

The obstacles to the practice of forestry by private owners are chiefly the danger from fire and the burden of a faulty system of forest taxation. Both fall within the field of state action; but the Forest Service stands ready to help the States in every way it can to work out a wise course of action. Many States have requested assistance in developing a forest policy. The recommendations of the Forest Service have ordinarily covered the appointment of a state forester or a forestry bureau to supervise the forest work of the State and to cooperate with private owners in assisting them to manage their forest lands properly; the enactment of laws for the protection of forest lands from fire by establishing fire warden systems, placing reasonable restrictions upon the use of fire, and providing suitable penalties for their infraction; the adjustment of taxes on forest lands so as to encourage the private owner to cut his timber conservatively and retain the land for future production; and the purchase or retention by the State of timbered or cut-over lands suitable for permanent state forests.

Preliminary examinations of forest conditions were made in Virginia, South Carolina, Mississippi, and Louisiana, in cooperation with different state departments. In all these States the forest-fire problem is a serious one, and in the reports on these examinations fire-protective systems were outlined. In Virginia particular attention was given the woodlots of shortleaf pine in the Piedmont region, with the view of helping the farmers to protect and make better use of this timber and to put it under practical forest management. In South Carolina, Mississippi, and Louisiana the chief forest problems besides fire are unrestricted grazing, waste in logging, and waste in turpentining.

Besides these preliminary examinations of forest conditions, detailed examinations were made in Illinois, western Kentucky, and western North Carolina. In Illinois the Forest Service cooperated with the state laboratory of natural history. The chief problem in that State is the care of the farmer's woodlot. Cooperation in Kentucky with the state board of agriculture, forestry, and immigration has covered three successive field seasons. The forests of the entire State have now been examined and mapped, and recommendations for a state forest policy have been made. The total amount of timber in the State is estimated at 23,000,000,000 board feet. At the present rate and under present methods of cutting this amount will last about fifteen years. It can be made continuous, however, through the practice of forestry. In North Carolina an examination similar to that in Kentucky was completed for the western part of the State. This work is in cooperation with the State Geological and Economic Survey and will probably continue until the entire State is covered. These detailed examinations are practically a stock taking of the forest resources of the States.

In Wisconsin a study was made in cooperation with the state forester to show the relation of forest taxation to forestry and to the

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future timber supply. This study will aid the Service and the State to reach a proper conclusion regarding forest taxation in the Lake States. The plan is to study the problem of forest taxation in typical forest regions of the country.

Cooperative experimental planting work was done with the New York forest, fish, and game commission, Albany; with the University of Maine, Orono; with Berea College, Berea, Ky.; with the Agricultural and Mechanical College, Agricultural College, Miss.; and with the Michigan Forest School, Ann Arbor. This work is to determine the practicability of forest planting in the different regions, the best trees to plant, and the cheapest way to grow them in the nursery. The experiments, for instance, of the New York forest, fish, and game commission have given valuable information on nursery practice. They have determined the proper quantity of seed of the different conifers to sow per bed, and they have shown among other things what is the best fertilizer for seed beds; that broadcasting the seed is preferable to drills; that water properly applied results in increasing the growth of the seedlings from 1 inch to 2 inches a year; that coniferous seedlings should be transplanted at the end of the first year; and that 3-year-old transplant stock is the largest size practicable for field planting.

The Forest Service receives a large number of applications for advice and assistance from private owners. In the early days of the forestry movement, when no other source of advice was open, the Service used so far as was practicable to send its men to examine private tracts and give advice upon the ground. Now many of the States have foresters, and applicants in such States are referred to them. There are now also consulting foresters, whom private owners of large tracts can and should employ. It is, however, still the policy of the Forest Service to help all applicants in every proper way. This is chiefly done by correspondence or conference. When there are a large number of applicants in a State which has no forester, and especially when they are owners of woodlots or small holdings, advice as to methods of management may be given upon the ground. This work, however, is intended to be educational in its scope, and is done with the expectation that all the States will eventually have foresters to look after it. During the year 72 examinations of private tracts and woodlots in 23 States were made, aggregating about 320,000 acres. Both the private and the state cooperative work are made means of investigation of forest conditions, as well as of practical assistance and educational value to the public. Much of the knowledge which the Forest Service now possesses has been gathered through such cooperative work.

OTHER INVESTIGATIONS.

SILVICULTURAL STUDIES.

An important study on the growth and management of Douglas fir in the Pacific Northwest was completed. It is of particular practical value because Douglas fir is the best tree of this region, of extremely rapid growth, of great size, and of valuable wood. The study shows that reforestation can be obtained at little expense after almost any Douglas fir logging operation by making provision for seed trees, burning the slash immediately after logging in order to expose the

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mineral soil in which the seed germinates, and then protecting the land from subsequent fires. These measures will promote the development of a second crop of growth as rapid and quality as high as the original forest.

In western Washington and Oregon Douglas fir is an extremely rapid growing tree. Measurements from trees grown on the better class of forest soils show that the average tree is 15 inches in diameter and over 100 feet high. It is not uncommon for trees from 10 to 30 years old to add 4 feet to their height and three-fourths of an inch to their diameter in one year. At 50 years the average tree contains 238 board feet, and at 60 years 386 board feet. Between 50 and 60 years old the average stand per acre will increase from 28,000 to 41,000 board feet, or 1,300 board feet per year, and between 60 and 80 years the rate of growth is still greater. Under conservative forest management it will be most profitable to grow Douglas fir on a rotation of about 80 years, when the yield per acre is about 70,000 board feet. This may seem a very short rotation, considering that the majority of timber now standing in Washington and Oregon is upwards of 200 years old. That the growing of Douglas fir on cut-over areas will be financially profitable to private owners as well as to the Government seems assured in view of the certain rise in the value of stumpage and the growing scarcity of timber land investments, provided the present system of taxing timber lands is reformed.

Much interest has developed in Florida in the possibility of growing eucalypts for commercial purposes. The Forest Service undertook last winter an investigation to learn what species of eucalypts can be successfully grown in different parts of the State. Some fifteen different species were found growing in various places with varying degrees of success. The region in which eucalypts can be successfully grown may be roughly defined as the orange belt, or about 40 per cent of the total area of the State. The climate and soil conditions there compare favorably with those of the native habitat of these trees in Australia. Tentative conclusions were reached as to the species seemingly suited to the climatic conditions and the methods of raising and planting the young trees likely to be successful. To supplement the knowledge already obtained, a series of experiments in planting is now being carried on at Miami, in cooperation with the Bureau of Plant Industry. These experiments will extend over a period of about five years, at the end of which time it is believed that full knowledge of how to grow young plants and of what varieties are adapted to different parts of the State will have been gained.

In a study of yield from eucalypt plantations made in cooperation with the California state board of forestry practically all the important eucalypt groves in the State were examined. Sample plots, usually a quarter of an acre in area, were measured off within groves showing the best growth. At seven years the yield per acre was estimated at from 1,600 to 2,300 board feet; at ten years from 13,000 to 16,000 board feet. Groves of from 20 to 30 years of age yield from 20,000 to 35,000 board feet, according to the quality of soil in which the trees were grown. This study shows that many of the claims of extraordinary yields are considerably exaggerated.

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Because of the great abundance in many regions of aspen trees, their good and bad effects on other species, and their undoubted value, particularly for wood pulp and excelsior, they will always form an important element in the northern forests. On this account a study was made of these trees. Until the usefulness of aspen for paper was discovered, it was considered an encumbrance of the ground. As with a few other species, fire, properly handled, is a silvicultural tool of great importance for regenerating aspen stands, since it exposes the mineral soil, clears land of brush and shrubs, and prepares the ground for the thrifty development of the trees. The advantages of aspen as a perpetual crop lie in its adaptability to short rotations on account of its relatively rapid growth and the small sizes which are merchantable, and in its usefulness in the paper-making industry.

During the year permanent sample plots established in several of the Eastern States in 1904, 1905, and 1906 were remeasured. The purpose of these plots is to determine by repeated measurements the exact effect of certain methods of treatment. Usually two plots are carefully laid off in the same stand, one of which is treated and the other remains intact for comparison. The experiments cover a considerable range of subjects, such as the effect of thinnings, the best methods of securing natural reproduction, the development of reproduction under different conditions, the effects of fire, and artificial reproduction.

The experiments in thinnings in white pine showed that a stand 40 years old in 1905, thinned at that time by the removal of 1,360 cubic feet per acre, had increased in volume during the five-year period at a rate over 40 per cent greater than that of the corresponding unthinned stand. A still greater advantage is gained in the decided quality increase. There is also a substantial yield in material.

Studies were made of the potential range in the United States of a number of European trees.

In the basket-willow investigations of ten or twelve European varieties of willow, a three years' test has shown only the three species *Salix amygdalina americana*, *S. daphnoides*, and *S. purpurea* No. 2 to be of value. However, further experiments will be made with *S. purpurea* × *viminalis* and *S. dasyclados*, as they may respond to special treatment. A distribution of cuttings was made in the spring. A call for reports from all persons who had previously received free cuttings brought replies from 41 per cent, of whom about one-half reported success. The basket-willow experiments were extended by the establishment of a willow holt at Blacksburg, Va., and lowland and upland holts at College Park, Md., under formal cooperative agreements with the respective state experiment stations. Less formal cooperative work was begun at Salamanca, N. Y., Sitka, Alaska, and South Framingham, Mass. A cooperative experiment with New Jersey was planned for 1911.

Trial of American species of willow as basket willows was begun in the spring. Of ten species planted three made an excellent growth for the first year. From thirty to forty species and varieties from many sources will be planted in 1911. The results thus far obtained indicate that some of the native species may be adaptable to basket-willow culture.

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The gathering of data for the mapping of the range of American forest trees and the distribution of woodlands in the United States was continued. Dendrological studies of structural characteristics of North American woods, to the end that identification of commercial woods may be facilitated and made more certain, was also continued. The latter work is of decided practical importance in that it provides a means by which the purchaser of specified material may be assured of the delivery of what he has contracted for, without substitution of an inferior or cheaper material. The results of this sort of information were practically applied in determining for the Isthmian Canal Commission the species of oak and hickory furnished or offered in certain manufactured forms for use in the building of the Panama Canal. The oak was in the form of dimension lumber delivered under contracts, while the hickory was submitted as samples in connection with bids for the supply of tool handles. It was found that red, black, Spanish, and water oaks were frequently furnished for white oak, and that in the manufacture of handles inferior species of hickory were often used instead of white hickory. In connection with the dendrological work advice was also given to the cities of Baltimore and Richmond and the United States Naval Academy concerning the pruning and care of trees. A large number of tree specimens were identified in connection with the Forest Service work, for the Biological Survey and other Government bureaus, and for the public. The Forest Service herbarium and wood collections, which assist in the identifications of woods and tree species, were enlarged.

A new and hitherto undescribed species of cypress was discovered in Arizona and given the name of *Cupressus glabra*. It is a forest-forming species of local importance, which has hitherto not been distinguished from the *Cupressus arizonica*.

In preparation for the issuing of the second volume in the series dealing regionally with the forest trees of the United States both field studies and office compilation of field data were continued. This second volume will have for its subject "Forest Trees of the Rocky Mountains," and will be closely similar to the already published "Forest Trees of the Pacific Slope." The work is expected to be ready for publication before the close of the present fiscal year.

STUDIES OF FOREST PRODUCTS.

The most important events of the year in connection with the investigations of forest products have been the securing of greatly enlarged facilities for laboratory work and the transfer of the Office of Wood Utilization from Washington to Chicago, where it is in much closer touch with the great forest regions of the South, North, and West, and with the industries which use forest products.

The chief work of the Branch of Products is to bring about the most economical use of the material which the forest supplies. This is at present impossible because of incomplete knowledge. The problems are complex. They are deeply scientific and broadly commercial. They can not be solved without thorough scientific investigation; and, once obtained, the solutions can not be applied without a complete knowledge of commercial conditions among the many diverse industries which make use of wood. The Forest Service now possesses facilities which it has previously lacked for carrying on fundamental investigations of this kind under thoroughly favorable conditions.

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With all of the investigative work of the Branch of Products centered at Madison and Chicago, it appeared advisable to establish the administrative office also at one of these points. Since the larger part of the organization is at Madison, the administrative office was transferred thither. This was done on June 1. The Branch of Products is also represented by field offices in Denver, San Francisco, and Portland, which carry on the work in Districts 2, 5, and 6, and by an office at Washington, D. C.

In consequence of the new facilities for careful and scientific investigation and experiment, both the methods and the character of the work have, to a considerable extent, been modified. When the Government lacked adequate means for investigating the underlying problems in the use of forest products, experiments were of necessity limited and attention was centered principally upon field demonstrations of the practicability of processes the intrinsic value of which were already known. Facilities for investigation were ordinarily obtained through cooperation with individuals or companies, especially in such fields as wood preservation and wood distillation. Now that adequate facilities are available, it is possible to go into the deep, underlying problems. Moreover, it is in a large degree possible now to transfer cooperation from individuals to large associations, and results secured in this way will be much more completely available for the entire industry which the work concerns.

FOREST PRODUCTS LABORATORY.

The agreement entered into with the University of Wisconsin for a forest products laboratory at Madison was announced in the last annual report. The university erected a building at a cost of about $50,000, and supplies heat, light, water, and electric and steam power. The Forest Service supplied and installed the testing machines and other apparatus, and furnishes the force of 50 experts and assistants engaged upon experiments. By this cooperation the United States has secured the largest and most completely equipped wood-testing laboratory to be found anywhere.

Plans for the new laboratory and for the installation of the equipment were carefully developed, and the building was constructed during the summer and fall of 1909. The technical and clerical force was transferred from Washington to Madison and occupied temporary offices on October 15. By December 1 the building had reached a stage at which installation of the machinery could begin. On April 1 the offices in the new building were occupied, and on June 4, with nearly 500 visitors present, the laboratory was formally opened. Many of the visitors were representatives of lumber associations or associations of wood users.

The work of the laboratory is organized in three groups of three sections each. The first group may be designated the chemical group. In it are the sections of chemistry, pulp, and distillation. The section of chemistry devotes itself to the study of problems concerning the chemical constituents and conditions of wood, and the analyses and standardization of wood preservatives. The section of pulp studies the fiber characteristics of woods to determine their value for various classes of pulp. The first work of this section, a work for which Congress has made a special appropriation, is to determine whether it is possible to find a substitute for spruce in the

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manufacture of ground wood pulp. The section of distillation studies the possibility of developing valuable chemical by-products of wood by distillation processes. This section should greatly reduce waste by recovery of materials such as alcohol, turpentine, oils, and gums, in which many of our commercial woods are rich.

The second group, properly called the physical group, contains the sections of wood preservation, pathology, and wood physics. Wood preservation covers the treatment of wood by substances to improve its durability or appearance. The preservative treatment of wood, as an industry, is new in the United States, but of rapidly increasing importance, and it is already beginning to work a noticeable reduction in the waste of wood caused by decay, insects, and marine borers. Many of the fundamental problems are yet to be solved, and on these the section of wood preservation is working. Closely allied with it is the section of pathology, which investigates the diseases of wood. The Bureau of Plant Industry furnishes the personnel of this section and supervises its technical methods. The section of wood physics investigates the microscopic structure of wood and the relation between structure and physical properties, such as strength, toughness, and penetrability to liquids. It has many problems awaiting it.

The third group contains two sections, which rest substantially on mechanical engineering. It may, therefore, be called the engineering group. The first is the section of timber tests, which seeks, through mechanical tests, reliable data on the relative value of our commercial woods for specific purposes. The second section, that of engineering, has to do mainly with the design of equipment and machines to be used for the discovery and demonstration of methods to reduce waste. Efficiency in lessening wood waste will depend in great part upon the efficiency of the machines and equipment designed for the work. Third in this group is the section of maintenance, which cares for the upkeep and unimpeded operation of the laboratory.

Progress was made during the year in projects which pertain to the work of these three groups, as follows:

CHEMICAL STUDIES.—A revision of gum turpentine specifications was undertaken and is still in progress. As a basis for the revision, flash-point and specific-gravity tests were made on a large number of samples. Approximately 125 moisture-determination tests were made in connection with the strength tests of treated timbers. Study of methods of analysis of turpentine were continued. In the turpentine-refining still built for the Forest Service, as announced in last year's report, several samples of four barrels each of crude wood turpentine were refined. This still is a three-product, continuous-column still of new design. It was found that the proportion of refined turpentine produced was greater than that produced by the old methods at the commercial plants from the same crude turpentine; and the feasibility of using a continuous-column still over the old-form still was demonstrated.

In testing the fiber value of different woods for pulp purposes, 58 soda cooks were made on 13 different species, and bleach tests were made on 48 samples. Effort in this field was, however, mainly given to working up the investigations of previous years and to installing the equipment in the new laboratory.

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PHYSICAL STUDIES.—In cooperation with the Alabama Wood Preserving Company, of Birmingham, Ala., a design for a timber-treating plant was prepared, and a portion of the preliminary construction work supervised by a representative of the Forest Service. The work was closed during the year. The design and experimental operation of timber-treating plants in cooperation with the Tennessee Coal and Iron Company, of Birmingham, Ala., was brought to a successful end on May 1, 1910, after designs for two treating plants submitted to the company had been accepted and the construction and experimental operation of both of these plants supervised by a representative of the Forest Service. The final report covering this work is in preparation. In the work in cooperation with the Indianapolis, Columbus and Southern Traction Company, at Columbus, Ind., inaugurated in 1908 and actively entered upon one year later, a representative of the Forest Service supervised the construction of a tie-treating plant designed by the Service, and operated it experimentally until October 12, 1909, when the methods of treatment were thoroughly established and cooperative work was terminated.

Considerable attention was devoted to the design and construction of apparatus for the prevention of sap stain. A report giving recommendations for future policy and preparing a design of equipment for use was prepared. The final form to be given the proposed plant, however, awaits further investigations of the methods of preventing sap stain in lumber, tests of which are to be carried out at the laboratory.

ENGINEERING STUDIES.—The tests to determine the effect of preservative treatment upon the strength of yellow-pine timber, conducted in cooperation with the Illinois Central Railroad, were completed. Longleaf and shortleaf pine bridge stringers and railroad ties of a number of species were tested. Some of the investigations made are published in a report of the committee on wood preservation of the American Railway Engineering and Maintenance of Way Association. It was found that steaming at low pressures, such as 30 pounds to the inch, saturates the wood and renders it weak, but that the strength to a large extent returns on subsequent drying; also that the difference in absorption of creosote oil in different pieces is notable, and that there is marked evaporation of the oil upon exposure. In the experiment over half of the oil seemed to disappear within nine months.

Tests to determine the mechanical properties of different species of hickory were also completed. A partial summary of results has been incorporated in a report on the commercial hickories and is being published. On the whole, pignut, or black hickory, gave the best results in the tests. It is closely followed by shagbark, which, in addition to its valuable wood, furnishes an important edible nut. Mockernut has nothing to recommend it over pignut. Pecan hickories, though of faster growth than true hickories, have inferior wood. The tests show that the prejudice which exists against the heartwood of hickory is unfounded. In old trees the best wood may be in the heart, while in young trees the best wood is likely to be in the sap.

Material progress was made in working up the tests to determine the effect of different methods of drying on the strength of timber, which have been under way for two years.

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OFFICE OF WOOD UTILIZATION.

Correlated with the Forest Products Laboratory is the Office of Wood Utilization, with headquarters in Chicago. Its work also is investigative, but by statistical rather than by experimental processes. It gathers data to show where, why, and in what quantity wood is wasted in the industries, and endeavors to find means for reducing this waste. It studies the wood-using industries of cities and States, learns their requirements, and aids them to find cheap and abundant woods in place of scarce and costly ones. It is also gathering a record of wholesale lumber prices at the mills and in the principal distributing markets. These make it possible to compare lumber prices in different regions and markets, and to determine in a broad way the influences which may be operating to raise, lower, or hold steady the prices of lumber.

The Office of Wood Utilization was transferred from Washington to Chicago October 1, 1909. The advantages of this transfer are obvious. Chicago is the headquarters of seventeen important lumbering and wood-using associations, many of them national in scope. It is largely through these associations that progress toward better use of wood must be made, and with some of these associations the service is cooperating on one or more lines of investigation, while from all of them it obtains information and suggestions. Again, the lumber trade and lumber requirements of Chicago are so diversified that probably no other city affords equal opportunities for securing data. Every line of wood-consuming industry is represented in the city, so that immediate information upon the processes of any kind of wood manufacture can be readily secured. Furthermore, Chicago is believed to be the greatest lumber market in the world. Approximately 6 per cent of the total cut of all the mills of the country is handled by the Chicago trade, and about 300,000,000 feet of lumber is constantly on pile in the city yards. More lumbermen visit Chicago each year than any other city. Chicago is also the publication headquarters of three of the foremost lumber-trade journals and of a number of publications of affiliated industries, and practically all of the important trade journals are represented in that city. All of these considerations make Chicago the most advantageous point in the country for the Office of Wood Utilization.

In the Office of Wood Utilization continuous investigations were possible through the larger part of the year. Among other questions of practical interest to the lumbermen which were taken up is that of the manufacture and marketing of odd lengths of lumber in the various producing regions. This was studied in the yellow-pine region of the South and in the Douglas-fir region of the Northwest. It was found that on the Pacific coast 2.07 per cent and in the South 1.21 per cent more lumber could be produced from the raw product by the manufacture of odd lengths. Another study under way is that of pencil woods. A number of National Forest woods which, from their physical properties, seem suitable substitutes for the southern junipers, and some other woods not found in the National Forests, are now under trial by pencil manufacturers. If any of these woods prove to be suited to the purpose, a market will be found for heretofore little used National Forest woods, and manufacturers will be given a new source of supply.

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The growing scarcity of woods suitable for the manufacture of bobbins and shuttles recently led the Service to take up this question with interested manufacturers. The United States Bobbin and Shuttle Company is testing at its plant at Lawrence, Mass., a number of hard woods from the National Forests of the Pacific coast States which, from their physical and mechanical properties, seem well suited for this use.

Throughout the lumber-producing regions there is much waste at the mills due to the difficulty in disposing of short lengths. The cypress manufacturers, among others, have experienced trouble along this line. Experiments are now being made to learn whether cypress can be used for plug-tobacco boxes and butter tubs, which would open a considerable market for short lengths of this wood. The high price and growing scarcity of Spanish cedar, used in the manufacture of cigar boxes, has led the Service to look for other woods adapted to this purpose. The Chicago Box Company is now experimenting with the incense cedar, a western tree abundant on many of the National Forests. If incense cedar proves its worth for this use, both the cigar-box manufacturers and the National Forests will be benefited.

A most important wood in this country, one for which, on account of its peculiar properties, no substitute has been found, yet one of which the supply is very rapidly diminishing, is hickory. The Forest Service has in the past studied the conditions necessary to grow this wood, and has tested its strength, but little attention has been given to the method of manufacture of hickory products. At the request of the National Hickory Association, the Forest Service has begun a study which is expected to find what amount of hickory goes into unessential uses and to indicate such changes in the methods and organization of the industry as may be necessary to draw this supply into uses which essentially demand it.

A study of the uses of the various woods of the United States is under way. Each wood's physical properties, particularly its weight, hardness, color, ease or difficulty in working and finishing, enduring qualities when exposed to weather, and strength and elasticity, are listed, and data are assembled concerning its utilization from early times to the present, with an account of influences which have brought about changes in its use. Special consideration is given to the properties or other factors which seem to give the wood a value in present and prospective manufacturing. The study will cover about 200 species, one-half of which are of considerable importance. No wood is included that has not been reported for some use other than fuel. It is believed that, as forestry develops in this country, the woodlot owner and the lumberman will specialize more and more, as orchardists now do, upon the species which will pay best, and that in doing so they will need such information as is now being gathered. For certain species the work has advanced far enough to warrant publication during the coming year.

Reports prepared primarily to assist in the proper disposition of National Forest timber, and comprising information on the kinds and classes of material used, the principal sources of supply, and the disposition of the material shipped out, were made for a number of markets in the West. The reports aided materially in finding purchasers and markets for timber, and in fixing the price of stumpage.

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Statistics covering the output of forest products for the calendar year 1909 were collected by the Bureau of the Census in cooperation with the Forest Service.

Statistics of consumption of forest products have keen taken up cooperatively with the state forest officers in Massachusetts, North Carolina, Kentucky, Wisconsin, and Maryland. Statistics covering the consumption of forest products in Illinois and in Districts 2, 3, and 4 have been taken up entirely by the Service. The Massachusetts and Wisconsin reports have already been issued. The North Carolina, Maryland, and Kentucky reports are now in the hands of the printer, and the Illinois and District reports are being tabulated. Except in the case of Illinois, all of the reports are published by the State.

These reports are intended to be useful to both growers and manufacturers of wood. They show what part of the demand for each species is met by forests and woodlots in the State and what part is supplied from without. The kinds of wood demanded by the various industries are shown, together with the amount of each species used, the prices paid at the factory, and into what product each wood is manufactured. With this information before them, the woodlot and timberland owners who are looking to the future can determine what kinds of timber promise best returns, and can give preference to those kinds. Those who have timber or lumber to sell can form an intelligent opinion as to the uses to which it can be put and where the best market may be found for what they have to offer. On the other hand, the manufacturer who is in the market for woods of certain kinds will have the means to determine whether he can buy near home or whether he must look beyond the State; and a study of average prices paid by others will show whether or not he has been buying on an equal footing with others. A closer acquaintance between buyer and seller, with a better understanding of what one has to sell and what the other wishes to buy, is resulting from this work.

Statistics covering the consumption of wood preservatives in the United States in 1909 were collected from 46 firms, operating 64 timber-treating plants. This represented 93 per cent of the plants in operation during that year. The figures show the use of 51,500,000 gallons of creosote, 16,250,000 pounds of zinc chloride, and small quantities of crude oil, corrosive sublimate, coal tar, and water-gas tar. This is a smaller consumption than that in 1908, when 44 firms, operating 64 treating plants, reported a use of 56,000,000 gallons of creosote and 19,000,000 pounds of zinc chloride. Assuming that, on an average, 1 gallon of creosote and one-half pound of zinc chloride will protect a cubic foot of timber from decay, more than 80,000,000 cubic feet of cross-ties, piling, poles, paving blocks, and mine and other timbers were given a treatment that will greatly increase their life and usefulness. These statistics were collected in cooperation with the Wood Preservers' Association.

Although the lumber industry is the fourth largest manufacturing industry in the United States, up to 1908 it had no authentic published records of the selling prices of its products. During that year the collection of price statistics was inaugurated by the Forest Service. A list of wholesale prices in the principal markets of the country was issued monthly until September 30, 1909, when it was

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changed to a quarterly. The first quarter covered October, November, and December, 1909. The list now covers 21 markets and has about 450 cooperators among the wholesale lumbermen. A record of f. o. b. mill prices was first issued in July, 1909, and contained figures for the three months ending June 30 of that year. Records of these prices have been issued quarterly since then.

The first list is not confined to high grades, but gives those which are characteristic of the individual markets. The record of mill prices gives the grades which form the bulk of the material manufactured, and contains, therefore, more medium and low grades than high ones. On this account the grades in the two records are not entirely comparable. Numerous changes have been made in them from time to time, in order to make the publication more comprehensive. These changes have been made largely at the suggestion of practical lumbermen and the secretaries of the various lumber manufacturers' associations.

The two records of prices have been commended by the lumbermen generally, and their collection and publication has been indorsed by a number of associations. Manufacturers and dealers in lumber have promptly responded to requests for prices, and an acknowledgment is due them for their hearty cooperation in this work.

One of the most important problems before the lumber manufacturers to-day is the disposition of low-grade lumber. It is becoming more serious with the steady increase in the percentage of low-grade lumber produced. A solution of the problem is eagerly awaited by the manufacturers. The transportation rates on a given kind of lumber are now generally the same for all grades. The result is that the lower grades, which bring a low price but which cost nearly as much to manufacture as the upper grades, can not go far to market. This increases greatly the waste in the woods and at the mill. Could the lumber manufacturers have lower rates for low-grade products, an important advance in forest utilization would be made. This question is being studied from the standpoint both of the manufacturer and of the railroads, for the purpose of determining the advantages and disadvantages which a change in the charge for transportation might bring to each.

Existing rates are also a serious obstacle to a better utilization of forest material through the manufacture of certain small products from the waste material left over in the manufacture of large products. If waste material were given a lower classification and consequently a lower rate by transportation companies, an important saving would be possible.

The present system of lumber manufacturers' "grading rules" and consumers' "specifications" is responsible for much waste of wood. The ideal condition, and one which it seems poss ble to attain, would be to have the "grading rules" and "specifications" one and the same, at least for the raw material bought in the form of boards, plank, and dimension stuff for use by the furniture, vehicle, implement, and other industries. The Service is making a comparison of the various "grading rules" which have been adopted by the manufacturing associations, and of the "specifications" in use by a number of the wood-using industries, for the purpose of determining if the two can not be consolidated. If this could be done, a great deal of waste in the woods, at the mill, and at the factory would be prevented.

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MISCELLANEOUS.

In addition to the detailed operations outlined in the preceding pages, the activities of the Forest Service have included planning for and taking care of exhibits and exhibit material at expositions; responses to requests for addresses before users of forest products, trade associations, woodlot owners, forestry schools, and other audiences; custody and use of lantern slides; and cooperation with those engaged in teaching work, the latter including the originating of publications planned specifically for the assistance of teachers interested in forestry.

There were issued during the year 27 new publications and 101 reprints. The total number of Forest Servicepublications distributed was about 406,000, as against nearly 1,497,000 in the previous year. This large reduction in the number of publications distributed is partly due to the fact that those issued were in much greater proportion of too technical a character to be printed in large editions and distributed widely.

The record of public addresses by members of the Forest Service shows a total of 339 delivered during the year, of which 192 were delivered at expositions. Most of the latter were at the Alaska-Yukon-Pacific Exposition at Seattle, at which a daily program of lectures by various government officers included talks on forestry and the work of the Forest Service, given by the member of the Service who was in charge of its exhibit in the government building.

Exhibits were made at four expositions: The Alaska-Yukon-Pacific Exposition, at Seattle; a land and irrigation exposition, at Chicago; a national corn exposition, at Omaha; and the Arkansas State Fair, at Hot Springs. Material was sent also to the International Agricultural Exposition at Buenos Aires.

Cooperation with schools and teachers was continued. Of 287 normal schools in the United States, 144 now include in their curriculum some teaching relating to forestry or tree study. By an arrangement entered into during the year, this cooperation is now conducted by the Forest Service jointly with and under the general supervision of the Office of Experiment Stations of the Department of Agriculture, since all work of the Department related to agricultural education in the public schools is centered in that office. The Office of Experiment Stations is responsible for the general policy and methods of the work, while the Forest Service is responsible for the accuracy and sufficiency of the material from the standpoint of forestry.

The work of the year included the writing of publications to be issued by the Department, prepared with specific reference to the needs and practical requirements of teachers under actual school conditions by an expert in educational work.

WORK FOR THE ENSUING YEAR.

The work planned for the ensuing year will be outlined under the five administrative branches of the Forest Service. These are Lands, Operation, Silviculture, Grazing, and Products.

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BRANCH OF LANDS.

The new form of power agreement mentioned on page 11 will be perfected as rapidly as possible. It is desired to secure the criticism of all who are in touch with the subject and care to express themselves concerning the specific features of the agreement, in order that it may be well adapted to its work. When it has been completed, permits will be issued under it. Holders of permits under the old form of agreement will not be required to substitute the new form for the old unless they choose to do so. It is believed, however, that because of the fact that the new agreement imposes a lower charge than the old those to whom permits have been issued will prefer to surrender them and take out in their place permits under the new form.

To strengthen the force of examiners of land sought for the development of hydroelectric power there will be established a civil-service register for hydroelectrical engineer, from which appointments of men properly equipped for this work may be made.

In the claims work of the Forest Service an effort will be made to simplify the procedure and at the same time to bring about closer cooperation between the Forest Service, the Office of the Solicitor of the Department of Agriculture, and the General Land Office. In general, the aim will be to secure a form of procedure which will at once safeguard the interests of the Government and the public in prevention of the illegal passing of title of National Forest lands to private persons and avoid the laying of hardship upon bona fide claimants who have substantially fulfilled the requirements of law.

Examinations of claims made by Forest officers will result in a report of the facts found by the examiner, which will be submitted to the District Forester, who, if he thinks that a contest should not be instituted, will mark the report "No protest" and send it directly to the chief of field division concerned; but if the District Forester thinks that a contest should be instituted, he will submit the report to the Assistant to the Solicitor, who will examine it with reference to the evidence submitted and the law involved, and, if satisfied that a contest should be instituted, will frame the charges to be recommended to the Chief of Field Division by the District Forester. Upon the submission of the report and recommended charges to the Chief of Field Division, the question whether a hearing will be ordered will then be subject to his decision, with proper opportunity of appeal, in behalf of the Department of Agriculture, by the Solicitor's Office.

Although contest will not be initiated upon slight, technical noncompliance with the law, whenever it appears that an entry is not made or a claim initiated in good faith, but is believed to be a subterfuge to acquire title to timberland, or to control water, a water-power site, or rights of way, or to interfere materially with the essential interests of National Forest administration, the claim will be contested. No mining claim will be contested except after examination and report by a competent mineral examiner. Mining claims which manifestly do not affect Forest interests one way or another will not be given a mineral examination.

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BRANCH OF OPERATION.

The mapping and other work necessary to giving effect to the information obtained during the past year in the field examinations of the National Forest boundaries will be completed, and recommendations made of the additional boundary changes necessary to complete the elimination of lands not chiefly valuable for Forest purposes, and, so far as is possible under the law, the inclusion of outside lands which are chiefly valuable for those purposes.

The making of permanent improvements will of necessity be at a reduced rate during 1911 because of the fact that the appropriation for this purpose is less than half that for 1910. The $275,000 appropriated is approximately $1.06 per square mile of territory within the National Forests, exclusive of Alaska and Porto Rico. Keeping the present means of communication on the Forests in repair will doubtless consume a considerable part of the amount available, while the burning of a number of cabins and other improvements in the forest fires of the Northwest creates a further demand upon this fund for replacement. The amount of new work, therefore, can not be large.

The most important single problem of administration of the National Forests is to perfect a system of fire protection. Not only will the work of constructing trails, fire lines, and telephone lines be pushed as rapidly as the funds available permit, but steps will be taken to determine the most effective and most economical methods of organizing a patrol and fighting fires. The work in connection with fire protection may be grouped under the following heads:

(1) Extension of the system of roads, trails, and telephone lines.

(2) Construction of special fire lines at critical points, including the burning over of broad strips where this is practicable.

(3) The development of signal stations and watch towers.

(4) Experiments to develop the most practical systems of signalling, including the use of the heliograph, special lights at night, telegraph, etc.

(5) Experiments in the disposal of inflammable slash.

(6) Tests of methods and cost of fighting fires, including the use of trenches, back-firing, etc.

(7) Development of a system of patrol, looking to the necessities of each Forest for normal and abnormal seasons.

(8) Study of the effect of forest fires on soil, reproduction, rate of growth, etc.

Cooperation with States, communities, and individuals against fire will be continued. In the case of railroads operating within National Forests it is hoped to extend considerably the method of entering into cooperative agreements for joint action against fires, with acceptance of responsibility by the railroads for all losses resulting from fires which start along the rights of way unless the locomotives burn oil or use efficient spark arresters, or unless the companies show that the fires were not caused by the railroads.

As an additional safeguard against heavy deficiency expenditures, such as were necessary during the disastrous fires of 1910, the estimates for the next year will provide for an appropriation of $120,000 to be used in the temporary employment of extra men for patrol work during the months when the danger of fire is greatest. The amount

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estimated for will permit the addition of about 450 men to the Forest force for the comparatively short periods for which their services will be required.

BRANCH OF SILVICULTURE.

The greatest task in this branch during the ensuing year will be the disposition of the timber which has been killed by fire. There is an enormous quantity of this timber, much of it excellent white pine, fir, and larch. Where it is not too inaccessible to have any hope of finding a purchaser, it will be offered for sale at a decided reduction in price, and every effort will be made to secure its utilization in preference to green timber. A great deal of this timber, however, is located in the high mountains in inaccessible places and probably can not be disposed of before it becomes worthless through deterioration.

The work of estimating and mapping in detail the timber of the various Forests will be continued as extensively as the available funds permit. A certain amount of this work is absolutely essential to locate bodies of timber which should be cut and to organize the work of forest protection and improvement. The imperative need, however, of providing for fire protection makes it impossible to extend this work as rapidly as is desirable.

Another important line of silvicultural work is the determination of the best methods of cutting mature forests to secure natural reproduction. There are now available for observation the results of lumbering during the past five years, under timber sales made by the Forest Service; and in addition there are available the results of very many earlier cuttings made under ordinary lumbering methods. The latter, of course, took no account of the future welfare of the forests, but all timber sales made by the Forest Service prescribe a specific method of cutting, devised with reference to successful natural regeneration of the forest. By studying and comparing the results which have followed the different methods of lumbering practiced in the past it will be possible to direct future operations more intelligently.

Reforestation work on the National Forests will be pushed vigorously. It is expected to secure, by collection and purchase, over 80,000 pounds of seed, most of which will be used during the fiscal year 1911. There is probably not less than 5,000,000 acres of land within the National Forests which has been so completely denuded by fires that it must be reforested artificially. As a result of past experimental work and the selection and training of men, the Forest Service is now in a position to extend its reforesting operations very rapidly. It is planned during the year 1911 to cover over 20,000 acres, to double this amount the following year, and thereafter to enlarge the operations until from 150,000 to 200,000 acres a year can be reforested.

One of the means of carrying this work forward will be by the preparation of definite and specific reforesting plans for individual Forests. These plans will have for their object the ultimate complete restocking of all treeless areas which will not regenerate naturally within a reasonable time. Each year's work under such a plan will mean another step toward its realization. It is believed that progress will be much more rapid in the long run when all efforts are

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coordinated toward the attainment of a distant goal than if each year's work were undertaken without reference to such a plan. The method proposed is similar to that already adopted for permanent improvements, which are made each year on each Forest under an approved general plan for the complete development of the Forest as an administrative unit; just as the timber and grazing reconnaissance work aims at the application of a similar policy to the development and utilization of the wood-producing and forage-producing capacity of each Forest.

The experiments in reforestation will be continued along the following lines:

(1) Experiments in different methods of direct seeding. Special subjects of investigation through these experiments will be: (*a*) The results of sowing at different times of the year; (*b*) different methods of sowing the seed; (*c*) different methods of preparing the soil; (*d*) the invention of special devices and implements for direct sowing; (*e*) relative results of different amounts of seed per acre, under various sets of conditions; (*f*) use of different methods of poisoning to protect seeds from rodents; and (*g*) the most economical organization of sowing operations. Intensive methods will be compared, both as to results and as to cost, with those requiring less care, and seeding methods will be compared with planting methods, in order to learn both what course will secure the largest results in proportion to the expenditure and what methods are most rapid.

(2) Experiments in the suitability of different species to different sites and soils.

(3) Experiments in methods of nursery practice.

(4) Experiments in methods of field planting.

Study will also be given to economical methods of seed collecting and to the best methods of handling the seed.

Special studies of the different commercial trees will be carried forward with a view to the publication of monographs which will inform the public as to the characteristics of the different species and the best methods of handling forests of different types. These monographs will make use of a large volume of data already gathered concerning the rate of growth of different trees under various natural conditions. Such monograph studies now nearing completion include the white pine, the red pine, the loblolly pine, the western yellow pine, the lodgepole pine, the red spruce, the red oak, the chestnut, the tulip poplar, second-growth hardwoods of New England, second-growth hardwoods of the Appalachian region, and the chaparral forests of the Southwest. These species are treated primarily from the standpoint of their commercial importance and the methods of handling them to secure the highest possible returns from them. Studies of sugar pine, California red fir, and western white pine have been inaugurated.

The work of cooperation with States will continue as the various States request advice and assistance. Cooperative work in the State of Connecticut is under way with the special view of determining the best methods of handling second-growth hardwoods. In North Carolina the cooperative work will have special reference to the rate of growth of stands of second-growth shortleaf pine and hardwoods native to the State. A cooperative study of forest conditions will be made in Tennsesee with a view to assisting the State in developing a

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forest policy along the same lines as in Louisiana, Mississippi, Alabama, and other States which have cooperated with the Forest Service. In continuance of the plan for investigating, through studies in typical States, the relation of methods of forest taxation to forestry and future timber supplies, a study of this subject in the State of Washington will probably be undertaken. Such studies have already been made in New Hampshire and Wisconsin.

Formerly the Forest Service carried on extensive cooperative work with private owners, assisting them in developing plans for the handling of their woodlands and for reforestation. In proportion as this work can be taken up by the individual States and as private owners can secure the services of professional foresters the Forest Service will withdraw from it. At the present time a great deal of advice is given in the Washington office and by correspondence when reference of applicants to State foresters or to private consulting foresters is not possible.

BRANCH OF GRAZING.

The administrative work of this branch will in most respects continue along the same lines as during the past year. Only one important administrative change is being considered. This is the preparation of a plan by which authority may be delegated to the District Foresters to establish all but the yearlong grazing periods and fees; provision will be made, however, to keep the charge for equivalent privileges in different districts uniform.

The technical work of the branch presents for further investigation such problems as the restoration of depleted ranges, the development of the forage productivity of Forest lands, and the reduction of stock losses. The classes of studies to be pursued include the perfection and extension of improved methods of range control and the study of natural and artificial methods of reseeding overgrazed ranges. The scope of this work will depend entirely upon the number of technically trained men available for the proper direction of the experiments. The reconnaissance work must be left largely to the local force of Forest officers, working under the direction of experts; and the number of Forests upon which it will be initiated will depend wholly upon the number of crews which can be organized from the local rangers and guards and properly supervised by the men in general charge. The range-control studies will embrace a series of observations at the experimental lambing pastures on the Cochetopa Forest, and will be extended to other pastures as their construction and management becomes possible. The reseeding work will include a comprehensive study of ecological conditions upon the National Forests and a general extension of the actual reseeding operations.

The present force of technical men is not adequate to meet all of the demands, but will be sufficient to supervise the majority of the more important projects, and material progress toward the solution of the different grazing problems confronting the Forest Service is counted on.

BRANCH OF PRODUCTS.

The following projects have been approved and will be taken up as rapidly as they can be handled by the working force, although not all of them can be given attention in one year. The projects under

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each line of work are classified in two groups, of which the first constitutes those regarded as of major importance, the second those less important at the present time.

In timber tests the projects of major importance are: Tests to determine the effect on the strength of wood of solutions used for the prevention of sap stain; standard tests to determine the relative mechanical properties of the commercial woods of the United States; tests to determine the effect on the mechanical properties of wood of preservatives and preservative treatment; tests on built-up axles and hubs, and tests to determine the effect of different kinds and stages of decay on the mechanical properties of wood.

Minor projects are: Tests to determine the mechanical efficiency of joints and fastenings used in wooden structures; tests of the strength of built-up beams in comparison with that of solid beams; tests of vehicle and implement parts made of various species of eucalyptus; tests of the holding power of railroad spikes of various forms in various kinds of wood; tests to determine the relative strength of wood under dead, impact, and repetitive loading; tests of the relative strength of different kinds of wire-bound, veneer, and fiber-board boxes; tests of the relation between mechanical properties of Rocky Mountain woods and conditions affecting growth, such as soil, altitude, etc.; tests of the strength of structural timbers of Western hemlock and of green and fire-killed Douglas fir; strength tests of Western larch and aspen, and tests of Western hemlock and Douglas fir.

In wood preservation the major projects are the following: The preservative treatment of cross-ties; the effectiveness of different fractions of coal-tar creosote in preventing decay and in preventing the attacks of marine borers; the preservative treatment of silo timbers; the efficiency of different wood preservatives; experimental study of mechanical features of wood-preserving processes, including study of preliminary steaming, temperature of preservatives, pressure, and vacuum; prevention of sap stain; and the relative resistance of different species of wood to preservative treatment. Minor projects are: Determination of the quantity and character of distillates obtained from the treating cylinder during a hot bath; determination of the possibility of substituting treated gum for locust and other woods used for insulator pins; determination of the rate at which different grades and quantities of preservatives in wood lose their efficiency when exposed to the air only, when in contact with the soil, when underground, and when submerged under water; determination of the effect of moisture content, rate and condition of growth, and presence of bark upon the impregnation of wood with a preservative; and various projects in the experimental treatment of fence posts, poles, lumber, mine timbers, and paving blocks, and the construction and operation of treating plants of various kinds.

In timber physics the major projects include: Determinations of the specific heat of wood and wood substance and of the heat conductivity of wood under different conditions; methods of drying and conditioning lumber of different kinds and for different purposes; investigation of the fundamental laws of drying and of absorption; microscopic study of the structure of the principal native commercial woods and of the relation of structure to physical and mechanical properites; the effect of temperature upon the strength and

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physical properties of wood under certain specific conditions; and the effect upon the physical and mechanical properties of wood of heating under oil and other liquids. The minor projects include: Relations of the hydroscopic conditions of wood to temperature and vapor pressures; mechanical experiments and microscopic examinations to determine the effect of different processes of treatment upon the penetrability of wood to preservatives and gases; specific gravity determinations by differential immersion methods; and density of the wood substance of different species.

In the section of pulp, experiments and studies will be made to establish standard methods for determining the suitability of various forms of wood waste for the manufacture of pulp; to determine the suitability of various woods, including Eastern hemlock, birch, and jack pine, for the production of ground wood pulp; and to determine the suitability for the production of chemical pulp of jack pine, Eastern tamarack, Eastern red spruce, aspen (*Populus tremuloides*), Eastern hemlock, paper birch, yellow birch, Douglas fir, Western hemlock, lodgepole pine (green and fire-killed), longleaf pine, Engelmann spruce, redwood waste, cottonwood (*Populus deltoides* and *P. trichocarpa*), loblolly pine, barker waste, and white fir. It is also planned to take up later sycamore, red alder, beech, grand fir, maple, and cotton gum.

Wood distillation studies will include experiments to establish standard technical methods for determining the suitability of various woods for the production of distillation products under saturated-steam distillation and under direct-heat distillation; experiments and studies to determine the commercial feasibility of producing volatile oils and resins from different resinous woods by saturated-steam distillation, and of producing oils by direct-heat distillation, and to learn the common destructive distillation products; experiments and studies to determine the commercial feasibility of treating different non-resinous woods by direct-heat distillation for the production of the common destructive distillation products; experiments and studies in practical methods of extracting resins from different woods with volatile solvents; experiments to determine the effect of turpentine operations on the lumber value of the butt logs of longleaf pine; and experiments to determine the amount and composition of products obtained by standard methods of turpentining when applied to Western yellow pine.

The section of chemistry will study the revision of specifications for turpentine, the analysis and grading of commercial coal-tar creosotes, the quantity and quality of tannin in barks and woods not now used as a source of tannin material, and the chemical properties of various resins and gums, for the purpose of determining their composition and probable uses.

The section of engineering will give attention to the design of tie, pole, and post treating plants, the design of an experimental ground wood laboratory, the design and construction of an experimental dry kiln, and the devising of a hack for shallow turpentine chipping. It will also make an analytical study of the construction and operation of commercial turpentine distillation plants, to ascertain the conditions to which each class of plant is adapted, the difficulties encountered in its operation, and the best designs for the purpose in view; will design and construct a model of a sap-stain machine; will

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study and compile data on sawmill, logging, and miscellaneous wood-working machinery and on pulp grinders, barkers, machinery for shredding and hogging wood, and chippers; and will design experimental types of open-tank and pressure-treating plants for the treatment of posts, poles, ties, paving blocks, piling, etc.

Wood-utilization projects will include a study in cooperation with four manufacturers of the suitability for pencil manufacture of the following Western woods: Rocky Mountain red cedar, alligator juniper, Western juniper, redwood, incense cedar, Western red cedar, Port Orford cedar, Alaska cypress, and mountain cedar; a study of the suitability for shuttle manufacture of yellow cedar, Pacific yew, chinquapin, cascara sagrada, madroña, Pacific dogwood, and mountain mahogany; and studies of the suitability of short lengths of cypress for tobacco boxes and butter tubs, and the suitability of incense cedar for the manufacture of cigar boxes. A field study will be made of the manufacture of hickory products, and statistics of wood consumption will be obtained in Louisiana, Michigan, Missouri, and Pennsylvania. All of the various forest regions in the United States will then have been covered and information will be available on the uses of all the domestic and many foreign woods.

Statistics of prices will continue to be collected quarterly, both at the mills and in the wholesale distributing markets. There will also be made studies of substitution, which will include investigation of the substitution of fiber packages for wooden boxes, to learn the extent to which the substitution has gone and the character of the raw material going into the fiber packages, whether mill waste or material that should go into high-grade lumber; substitution of such materials as cement, concrete, tile, and prepared roofings for woods in general construction, instead of sheathing, siding, flooring, fencing, shingles, fence posts, etc.; substitution by the railroads in the manufacture of steel freight cars, passenger cars, and sleeping cars and in the use of concrete for trestles and bridges, stations, and platforms; and substitution in the furniture industry, as evidenced by the manufacture of metal filing and office cabinets, tables, show cases, ice boxes, and numerous other kinds of cheap and medium grades of furniture. The vehicle and implement industry is still another field where iron, steel, and aluminum are playing a large part in substitution. For each of these industries separate inquiries will seek authentic information of the present and probable future effect of substitution upon the demand for wood.

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REPORT OF THE CHEMIST.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF CHEMISTRY,
Washington, D. C., September 1, 1910.

SIR: I have the honor to transmit herewith the annual report of the Bureau of Chemistry for the year ending June 30, 1910, together with plans of the work proposed for the year ending June 30, 1911.

Respectfully,

H. W. WILEY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

IMPORTANT FOOD INVESTIGATIONS.

DETERIORATION OF POULTRY AND EGGS.

The investigation of the deterioration of foods, especially of poultry and eggs, instituted primarily to afford data for the enforcement of the food and drugs act, has progressed under the direction of M. E. Pennington, along the lines indicated in last year's report of the Food Research Laboratory. As there stated, this work, which begun with the study of cold-stored poultry, has led to the investigation of the handling of poultry in every phase from the producer to the consumer. The industries concerned are bringing their problems for solution, and are offering the most hearty cooperation in furthering the work, believing that by the improved methods evolved not only will losses be prevented, but it will be possible to put a better product on the market. The cooperators include not only associations of poultry dressers and merchants, but also railways, refrigerator transportation companies, and cold-storage warehousemen.

The laboratory studies on the decomposition of flesh, especially as influenced by temperature, have progressed far enough to warrant their collation. The results include data on the changes occurring in flesh when kept at temperatures below zero for varying periods of time, as well as those which occur at atmospheric and ordinary ice-box temperatures.

SHIPPING EXPERIMENTS.—During the summer of 1909 the Food Research Laboratory conducted a series of shipping experiments with Chicago as the receiving center. Chemists, bacteriologists, and field men from this laboratory established temporary headquarters in the Chicago food and drug inspection laboratory and conducted there the necessary laboratory work. Large poultry packing houses from

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southwestern Kansas to northern Iowa were visited; their methods of killing, picking, chilling, packing, and transportation were observed, and a shipment of poultry, of which an accurate record of every detail of manipulation had been kept, was sent to Chicago, where it went either into immediate consumption or into a cold-storage warehouse. In either event, the carload was met on its arrival, the conditions in the car after the railroad haul were noted, the boxes of poultry opened and examined, and typical specimens sent to the laboratory for immediate chemical and bacteriological examination. A number of these shipments have been traced after leaving their respective cold-storage warehouses in Chicago, and again examined after the second railroad haul and a short sojourn in a second warehouse before being placed on the market; some of them have been followed through the market as far as the retailer. At every step specimens were sent to the laboratory for examination. In this way it has been possible to study the practices of a number of packers over a large territory and to trace the results of methods, weather conditions, railroad facilities, etc., on the final condition of the product when it reaches the consumer. A study of the Chicago poultry market was also made, and is of especial interest, since this city, unlike most others, receives its poultry alive and kills and dresses within the city limits.

DRAWN AND UNDRAWN POULTRY.—Especial attention during the year has been given to the question of eviscerating poultry when killed or just before offering it for sale in the markets. Many shipments have been made from the large producing centers of the West to the consuming sections of the East of drawn and undrawn poultry, dressed by commercial and by experimental methods. The cooperation of the industry has permitted the examination and experimental use of much larger quantities of poultry than would have been possible otherwise, arrangements having been made whereby experimental packages, if not rendered unsalable, were turned back into stock and sold. Hence, this much debated question has been studied on a commercial scale, under existing as well as under experimental conditions, with every facility that the industry could offer to assist in solving the problem. To the visual examination of the fowls, at every stage of their preparation for the market and their journey through it, was added a chemical and bacteriological laboratory examination, that a standard record of changes in the flesh might be correlated with the history of the shipment, and thereby ultimately provide a scientific explanation for the undesirable fowls so often seen in the markets. Shipments were made during cold and during warm weather. Marketing included the handling of the goods by a commission man, and by a retailer who sold directly to the consumer. The results of this series of experiments are now being collected.

CONDITION OF POULTRY ON ENTERING STORAGE.—It is known that the successful cold storage of poultry depends very largely upon its condition when it enters the freezer. It has also been observed that the mode of dressing the birds influences the quality, especially after storage. This fact was brought out in several addresses to poultry men and warehousemen, the results of the experiments on scalded or dry-picked fowls, promptly stored or delayed before storage, etc., being illustrated by colored sketches of the birds so treated.

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The relative stability of the flesh of poultry well drained of blood, as compared with that which holds any quantity of blood in the tissues, as well as the more sightly appearance of the former, has led to a careful study of the whole matter. Shipping experiments, including marketing and experiments in the packing house, are now under way in the hope of obtaining practical information on this subject. Part of the work includes an anatomical study of the blood vessels of the neck and head of the chicken, that the methods of bleeding may be improved by a knowledge of the location of the vessels and the most available place for the cutting of them. The results of this part of the work have already been published in the form of a circular (Circular 61 of the Bureau of Chemistry).

HANDLING OF EGGS.—A study of the changes occurring in eggs after long keeping at low temperatures and after shorter periods at ordinary or incubator temperatures is in progress. Eggs of known history, from those of the highest quality to those of a low commercial grade, have been analyzed from time to time after keeping under definite conditions, and have also been studied bacteriologically. This work forms the scientific basis for the study of the commercial handling of eggs along the same lines as are being followed in the investigation of poultry. The details of this investigation and the arrangements for the cooperation of the industry are now completed, and it is expected that it will go forward promptly during the egg season of 1911. This work involves the careful tracing of commercial practices in the handling of eggs, from the producer to the consumer, and includes the study of the holding of eggs at various points, either for gain in price or through ignorance or carelessness; sorting and packing in the collecting centers; shipping to distant points; marketing by the jobber and retailer; and storage, from the season of production until the season of shortage. These records of history and environment are to be accompanied by a laboratory analysis at every stage.

FIELD LABORATORIES.—The development of the investigation of the handling of poultry and eggs intended for food and the ultimate effect of such handling on their wholesomeness has necessitated the installation of small laboratories at the packing houses where experiments are being conducted. One such laboratory was established in Atchison, Kans., for the winter of 1909–10, and did most effective work in defining the condition of poultry when fresh killed and the differences caused by various methods of dressing as exhibited by chemical and bacteriological findings. So valuable was the work done in this field laboratory that the establishment of such is now looked upon as an indispensable part of the field equipment. A brief mention, at least, must be made of the interest taken in the field laboratories by the packers themselves and the encouraging understanding which they evidence of the practical value to them of bacteriological and chemical findings.

During the latter part of the year work has been inaugurated in cooperation with the Bureau of Statistics, in order to obtain reports from the industry concerning the production and sectional distribution of poultry and eggs throughout the country.

ANALYTICAL WORK.—The analytical work of the laboratory, which furnishes, as has been stated, the foundation for all the field and

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market investigation and to which almost every problem must finally be referred for solution, necessitated the making of 3,006 determinations on 274 chicken samples and 43 egg samples. Three hundred bacteriological examinations of chicken and eggs were also made. The bacteriological work has included the study of growth conditions, especially as influenced by temperature, each culture or plating being grown at 0°, 20°, and 37° C. This has necessitated the making of a great number of plates, when quantitative results were desired, and has practically tripled the work done. A considerable number of organisms have also been isolated and identified. The histological examinations of the tissues have been made in connection with the bacteriological whenever it was desirable.

SUGARS AND SUGAR PRODUCTS.

MAPLE PRODUCTS.—The investigation on the maple products of the United States, begun a year ago, has been practically completed. The samples collected have all been analyzed, and the results on maple sirup have been compiled and are in press. An additional collection of maple sugars was made during the past season; these have been analyzed and the results are being compiled for publication as a companion report to that on maple sirups. It is thought that these data will be of material service to the food chemists of the country, as the large number of samples and their wide distribution will furnish a broad and reliable basis for the future valuation of this product.

Some experimental work on the manufacture of sirup and sugar from maple sap was done in order to obtain data on the chemical composition of the product as affected by the souring of sap and different methods of manufacture. While many valuable figures have been obtained, the investigation must be continued for several seasons in order to prove some of the points at issue.

EFFECT OF ENVIRONMENT ON SUGAR CONTENT OF CORN, ETC.—During this year Bulletin No. 127 on "The Influence of Environment on the Composition of Sweet Corn" has been published, which includes the results of a four years' investigation from 1905 to 1908. One additional season's work has been done on this subject, making a five years' study comparable to the similar one on sugar beets. The next products to be considered in this series of investigations on the influence of environment on the sugar content are cantaloupes and watermelons. As the quality of melons depends largely on their sugar content, and some sections produce much better melons than others, the work will be of great value in determining what features of the environment influence this content most. This work will be continued for five years in the same way as the two former investigations have been conducted. Stations have been selected in Florida, Arizona, Colorado, and some of the Northern States.

SUGAR BEETS.—The methods of analysis of sugar beets are under study to endeavor to adapt them more perfectly to commercial needs. As in previous years, a great many samples of beets have been analyzed for the Bureau of Plant Industry.

MISCELLANEOUS INVESTIGATIONS.—A large number of analyses of imported honeys have been made which, together with the results on

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American honeys already published, will be of great value to the food chemist in determining the character and purity of honey.

Samples have been collected and analyses begun in an investigation of the composition of American glucose and starch sugars. At present only a few scattered analyses of these products are available, and this work will be of material value to the food chemist in his valuation of sirup mixtures containing varying percentages of commercial glucose.

The general methods of sugar analysis are constantly being studied in the Sugar Laboratory, under the direction of the chief, A. H. Bryan. New methods as they are published in scientific literature along this particular line are tested and their value for the work in hand is studied. This often requires much work, and may produce only negative results, which are, however, as valuable as positive ones, since it is necessary to know whether the proposed methods are more accurate than those in use.

During the year 721 samples were received for analysis by the Sugar Laboratory, and on over 95 per cent of them a complete report has been made. Besides this, about 250 samples of maple sugars, collected during the preceding year, were analyzed, and approximately 30 samples of imported honeys. Classifying these samples, the distribution of the work is seen to be as follows:

Sugar-bearing plants:	
Beets	244
Cane and sorghum	62
Official food samples:	
Maple and cane sirups, molasses, and honeys	62
Imported honeys	39
Maple sirup and sugar samples	399
Samples from other laboratories and departments:	
Bureau of Engraving and Printing	14
General Supply Committee	26
Drug Laboratory samples	70
Other laboratories of the Bureau	8
Starch products	32
Miscellaneous sirups and sugars	45

BACTERIOCHEMICAL WORK.

The principal bacteriochemical investigation conducted has been that of the conditions surrounding the oyster and clam industry. This was continued from last year, and a decided improvement was noted in the methods of handling and shipping these valuable food products. Inspection of oyster beds, floats, shucking houses, containers, and shipping and transportation conditions, and bacteriological examinations of water, oysters, and clams were made in the course of this work. The inspection of mineral springs and bottling establishments is being continued, with the attendant bacteriological examinations, and similar cooperation is being given in the Bureau's investigation of the desiccated and frozen egg industry. Consignments of this product have already been seized and condemned as being composed of badly decomposed and filthy material. Assistance was also given in the milk campaigns conducted in Cincinnati and at Boston and Springfield. The results indicate the necessity for further activity along the lines of sanitary milk production. The increased

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use of milk ferments and kindred preparations is a subject now under consideration.

Much valuable information has been gained from the inspection of various factories in different sections of the country where foods are handled and prepared for human consumption. Conditions in milk depots, ice-cream factories, bakeries, candy kitchens, hotels, restaurants, boats, dining cars, etc., have been observed.

The number and nature of the samples examined is shown by the following tabulation of interstate samples and the statement as to research work:

Butter	12
Ketchup and ketchup material	65
Corn meals	18
Cream, raw and pasteurized	158
Cream puffs	18
Eggs:	
Desiccated	50
Frozen	50
Figs	10
Flour	34
Ice	21
Ice cream	42
Milk:	
Raw and pasteurized	756
Fermented-milk preparations	11
Miscellaneous	57
Oysters	69
Soft drinks	40
Water:	
Bottled	89
All others	22
Total	1,522

The research samples included 92 ciders, 209 samples of desiccated and frozen eggs, 145 samples of oysters, 287 samples of water from various sources, 115 samples of figs, and other miscellaneous materials aggregating 1,068, a total of 2,590 samples examined during the year.

SPECIAL INVESTIGATIONS OF THE DIVISION OF FOODS.

DETERMINATION OF COLORS IN FOODS.—Under the direction of Dr. B. C. Hesse, collaborating expert, New York City, a comprehensive study is in progress by A. M. Doyle, of the Washington Food Inspection Laboratory, looking to the classification of food colors and the construction of analytical trees for their identification. This investigation is extensive and intricate in the extreme and will require some time for its completion. The construction of the trees for greens, violets, and browns alone, which has been practically completed, involved the making of about 11,000 fundamental observations on 284 samples, in addition to which many hundred tests are made to assure the accuracy and reliability of the trees after their construction. These trees may be relied upon for concentrations ranging from 1 to 1,000 to 1 to 5,000; either side of this range their value has not been established. As far as the work has gone it does not appear that the impurities accompanying different makes of the same Green Table number interfere at all with the use of the trees; the only difficulty observed in this respect was in distinguishing a clean penta methyl

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violet from a poor grade of the hexa methyl violet, and this may be overcome.

The actual result of the work so far accomplished is therefore briefly as follows: Given 1 c. c. of a solution of any straight green, brown, or violet dye, containing not more than 1 milligram and not less than one-fifth milligram of such dye, the trees constructed enable one to designate with absolute certainty the exact Green Table number of said dye, with the following exceptions: (1) All browns from G. T. No. 137 to 139, but not between 137 and 139, one against the other; (2) all violets from G. T. No. 451 and 452, but not between the two, one against the other.

Similar trees will be worked out for the remaining colors—blue, orange, yellow, and red—and the influence of mixed dyes tested, for which work the fundamental material has already been collected. It will also be necessary to determine what effect, if any, the food material in which the dye is placed has upon the sensitiveness or reliability of the trees as constructed. If this influence is disturbing, then means of obtaining clean color solutions of the necessary strength must be devised.

The importance of this work in the enforcement of the food law is apparent. Notwithstanding the number and variety of colors encountered the continuation of this systematic study will soon place the matter on a practical working basis, the analytical trees furnishing a rapid method of identifying the colors, further confirmatory tests to be applied when deemed necessary. These studies are supplemented by others at the New York and Seattle food-inspection laboratories.

Codfish.—Codfish and other salt fish are subject to spoilage during the warm weather, particularly between the middle of June and October, and a careful study has been made by Inspector Bitting of the conditions surrounding the industry with a view to obviating or reducing the loss from this source. The first evidence of spoilage is a red discoloration, due to bacteria, and brown spots or "freckles," due to a mold. The specific organisms causing the spoilage have been determined and some of the conditions favorable to their growth established.

The preliminary work has been directed almost wholly toward finding the cause of the spoilage and the source of the infection. It has long been believed that the organisms causing the spoilage occur normally in the localities where the fish are packed and are abundant in the salt used for curing, possessing a tolerance for salt not common to most germs. The extensive bacteriological studies on the causes of reddening together with the inspection work present strong evidence that the difficulty is largely due to factory infection, use of contaminated water for washing the fish, and careless methods of handling, and that the influence of germs found in the lowlands, in the vicinity of the factory, and in the salt seems to have been overestimated. At first it was believed that the problem consisted in preventing spoilage in an infected product by stopping the growth of organisms necessarily present, but these investigations indicate strongly that it consists rather in the usual difficulty of preventing infection. Recommendations along these lines have been made in Bulletin No. 133, reporting the results of this investigation.

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KETCHUP.—Experiments have been continued by Mr. Bitting in the making of tomato ketchup to increase the time of keeping after opening the container. The work showed that ketchup could be made without any other preservative than sterilization, and such preservative action as may be exerted by the vinegar and sugar present, and have it keep as long as it remains sealed, and also for a reasonable time after opening. The ketchup first made had a specific gravity of about 1.06, a total acidity of less than 0.9, estimated as acetic acid, and about 6 per cent of sugar. In the subsequent experiments the aim has been to give a heavier body and a higher total acidity in order to offer greater resistance to germs which might find entrance after the bottle has been opened. It was found that ketchups having a specific gravity of more than 1.12, a total acidity of 1.2 per cent or more, estimated as acetic acid, and 12 per cent or more of sugar would keep. All of these figures were greatly exceeded in the experiments, and good ketchup may be made in which all or only one or two of the factors are increased. It is possible that there may be a decrease in these proportions, though with some risk. The greater concentration and the increase in sugar and vinegar have been the chief factors in securing a product of superior keeping properties, cleanliness and sterilization being always essential.

Examinations were made of commercial ketchups for their specific gravity, total acidity, condition of the tissues, and the organisms present. A comparison made with the record of a similar examination two years previous shows a decided improvement in this time. The ketchups were also compared by dividing them into two classes, those preserved with benzoate of soda and those preserved by sterilization, together with the preservative action exerted by the increased vinegar and sugar present. The latter class has a heavier body and consequently a slightly higher acidity than the former. The ketchups depending mainly upon sterilization and also upon increased vinegar and sugar and concentration for their keeping properties are generally made of higher grade material, and a smaller number of organisms are present than in the benzoated products, but there are clean ketchups and dirty ketchups in both classes.

The condition of the ketchup is determined by the appearance of the cells, whether they are broken or separated by fermentation or decay, and by the number and kind of organisms present and their condition. The general appearance of the ketchup and its color, taste, and smell may be easily modified by a skilled manufacturer, but no amount of cooking or finishing can change the microscopic structure.

FRUIT AND FRUIT PRODUCTS.—The experimental work on fruit and fruit products has been continued in collaboration with the pomologist in charge of the field investigations of the Bureau of Plant Industry. The fruits studied were grapes, apples, pineapples, peaches, plums, strawberries, raspberries, blackberries, huckleberries, currants, oranges, and lemons.

Investigations on grape juice were made with the object of studying the yields obtained by different methods of pressing and of heating before pressing and the effect of these various procedures on the composition and flavor, working on a scale which could readily be extended to commercial proportions. The studies on juices prepared

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from various other fruits have been continued, their nature being similar to those carried on with grapes. It is found, however, that each fruit presents peculiarities requiring slight modifications in treatment. These results were printed in the Journal of Industrial and Engineering Chemistry for July, 1909.

It has been found that freshly pressed apple juice, cooled immediately after preparation, can be kept for a period of from six weeks to three months at 32° F. before it begins to ferment, after which the fermentation is very slow and the flavor of the juice well maintained. Investigations made during the past season along this line have verified those previously made and show in addition that cider held at the freezing point on withdrawal from storage keeps well at refrigerator temperatures.

Another study on the value of peaches as vinegar stock was made, covering the composition of peach juices of different varieties, the fermentation of ground peaches, the composition of the resulting ciders, and the preparation and composition of peach vinegar. It appeared from this work that peaches contain sufficient fermentable sugar for use in this way and that they can be successfully handled by the machinery used for making apple vinegar.

Studies on the method of preparing dried, sugared pineapples have been continued and a very palatable product which keeps well has been produced. The samples held in cold storage retained to a great degree their original golden yellow color and the rich pineapple aroma and flavor. These three investigations have been recorded in Circulars 48, 51, and 57 of the Bureau of Chemistry.

Further investigations on Japanese persimmons have indicated that the Japanese process of ripening by using sake or dilute alcohol, as the liquid with which to saturate the walls of the vessel in which the fruit is stored, can be successfully applied commercially if the fruits are evenly ripened. Otherwise a considerable proportion of the fruit may soften unduly.

The study of the effect of low temperatures on the life processes of fruits has been continued and extended to several varieties of small fruit. In this study the rate of the evolution of carbon dioxid is used as a measure of physiological activity. In all cases thus far investigated cooling was found to cause marked retardations in the life processes.

In collaboration with the Bureau of Plant Industry a study is also being made of the composition of oranges at different stages of maturity with a view to elaborating, if possible, an analytical method by which data may be secured for the comparison and selection of types of oranges.

A study has been made of the practice of picking immature oranges and grape fruits and sweating them for the purpose of supplying the market in advance of the time of normal ripening. It appears that fruit so treated is so far inferior to that permitted to attain a reasonable degree of ripeness before picking that the continuance of the practice would be likely to work great injury to the industry. These fruit studies and the following food investigations are made under the direction of W. D. Bigelow.

CITRUS OILS AND CITRUS BY-PRODUCTS.—The examination of authentic samples of citrus oils obtained in Sicily will soon be com-

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pleted, and the special investigation of the production of citrus by-products in California, begun last year, is being continued. The methods for the manufacture of citric acid have been studied in the laboratory and the investigation is now awaiting the completion of a device for extracting oil. Whether or not such a device can be successfully operated will soon be ascertained.

DISTILLED SPIRITS.—The investigation of the methods of handling distilled spirits and the study of the changes taking place in storage of same under varying conditions, which was commenced two years ago, is still being carried on, samples being taken at regular intervals and general conditions noted. The data so obtained are of value in judging of the authenticity of samples in the enforcement of the food law.

CIDER VINEGAR.—A special study has been made of the changes taking place in the composition of apple cider when converted into vinegar in the commercial types of generators. In order to determine what changes take place when manufacturing on a commercial scale, the cooperation of a large vinegar factory in Michigan was obtained, thus making it possible to exercise chemical control of all of the operations under commercial conditions. Twice during the year, once in the winter and once in the summer, a 20,000-gallon tank of cider was run through a series of generators, and a careful note made of the changes of composition which occurred, thus covering also the effect of the seasonal changes in temperature on the action of the generators. This work is still in progress, and already important information has been obtained as to the composition of pure cider vinegars made on a commercial scale. In addition to the study of changes taking place in the manufacture of cider into vinegar, an elaborate chemical study of the composition of cider to be used in the manufacture of cider vinegar has been made in cooperation with the New York laboratory.

OCCURRENCE OF ARSENIC IN FOOD PRODUCTS.—The investigations of the Bureau have shown that certain materials, used both as drugs and in the manufacture of foods, sometimes contain a considerable amount of arsenic. For example, a number of samples of various types of foods, in the manufacture of which commercial preparations of phosphates and phosphoric acid were used, were found to contain an excessive amount of arsenic. A study has been begun to determine the prevalence of the use in the manufacture of foods of arsenic-bearing raw materials.

OYSTERS.—A number of cove-oyster canneries have been visited and samples prepared in the presence of the inspector have been examined in the laboratory. The data secured are of value in judging of the legality of shipments of cove oysters in interstate commerce.

INFLUENCE OF TIN RECEPTACLES ON THE CHARACTER AND COMPOSITION OF FOODS.—A careful study has been made of a large variety of foods canned in different grades of tin and prepared in the presence of representatives of the Department. This food will be examined periodically to determine the amount of tin dissolved therein and the extent to which the coating of the receptacle has been corroded. During the past year the first examination of all of the samples was made. For the same purpose there were examined some old samples

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of unknown origin. A study was also made under artificial conditions (imitating as closely as possible those obtaining in processing canned goods) of the solubility of tin plate in organic acids simulating the composition and acidity of vegetable and fruit juices.

EDIBLE OILS.—In collaboration with the Bureau of Plant Industry a study has been begun of the composition of a large number of varieties of soy beans and the character of their oil. Methods for the clarification of this oil and of peanut oil have also been studied.

ANALYTICAL METHODS.—Much progress has been made in the improvement of methods for the detection of food adulteration. New methods have been devised, improvements have been made in some of those formerly used, and by means of collaborative study the results of the various food laboratories of the Bureau have been brought in closer accord. The method for the quantitative determination of benzoic acid, which previously had been used especially with tomato ketchup, has been investigated in connection with other varieties of foods and found to be generally applicable.

The exact determination of the character and quantity of the various organic acids in different types of foods is of the utmost importance in the detection of food adulteration, since the organic acids of many foods are dissimilar from those of the products with which they are commonly adulterated. A careful study of methods for the detection and estimation of minute quantities of the common organic acids has been undertaken and marked progress has been made. This not only furnishes additional evidence of adulteration, but also valuable data respecting the soundness or decomposition of products from which certain types of food have been made.

The analytical methods used in foreign countries in testing American food products, especially those regarding fats and oils, have been under investigation, with the hope of bringing about some international agreement. The necessity for this work can not be overestimated, especially with regard to the great quantity of animal fats and oils exported to foreign countries, the acceptance of which is based on chemical analysis.

MISCELLANEOUS.—A considerable number of the samples examined was not included either in the ordinary investigations of the Bureau or in its work of inspection. Many materials were examined at the request of other departments for the purpose of determining their purity and quality. At the request of the General Supply Committee the division examined 235 samples of food submitted in connection with bids for government institutions.

DRUG INVESTIGATIONS.

Both the routine examinations and the special investigations conducted by the Division of Drugs, under the direction of L. F. Kebler, are chiefly concerned with the composition, adulteration, and misbranding of drugs and chemicals imported or found on the American market and shipped in interstate commerce or manufactured or produced in the United States territories or the District of Columbia. The chemical reagents used by the Bureau of Chemistry in its general analytical work are also examined by this division. These lines of work require a study of the methods of analysis, of the standards at

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present official for certain products, and of normal products, with a view to establishing standards and supplying the necessary data on which to base action. The study of the keeping qualities of hydrogen peroxid was completed and that on the deterioration of certain plant products and preparations derived from the same is still in progress.

Much work has been done to establish qualitative and quantitative methods for demonstrating the presence and determining the amounts of several constituents (i. e., morphin,[a] cocain,[a] acetanilid, antipyrin, chloral hydrate, opium, heroin, diacetylmorphin, the eucains, etc.) found in various mixtures, such as the so-called drug-addiction cures, asthma cures, cancer cures, consumption cures, soothing sirups, etc. During the fiscal year ending June 30, 1910, there were examined in this division 2,051 samples; of this number 503 were chemical reagents, 228 imported drugs, 1,184 domestic drugs or dry products, and 136 miscellaneous materials. These include all samples whether collected under the food and drugs act, examined for other branches of the Government, for information, or to be used as a basis for establishing the data on which to fix standards.

ESSENTIAL OILS.

Several years ago it was a common practice for various manufacturers to advertise the fact that their salicylic acid and sodium salicylate were made from oil of wintergreen. This representation was largely made because of the fact that the physician believed that the agents so obtained were more efficacious in the treatment of rheumatism than the synthetic products. Numerous complaints were received by doctors to the effect that the wintergreen salicylates they were employing did not give the results formerly obtained. An investigation soon showed that a comparatively small amount of actual oil of wintergreen was produced in the United States, but it was very difficult to prove that any given sample of salicylic acid or sodium salicylate was not made from oil of wintergreen. The results of the investigation soon manifested themselves in the trade, however, by the appearance of statements on labels as the following: "Salicylic acid natural," "Sodium salicylate natural," with nothing to indicate that these products had a common origin in oil of sweet birch, an oil analogous in many respects to oil of wintergreen, but not the same. In fact, no advertisements have appeared during the past year representing that these commodities were made from oil of wintergreen, but the natural products are still on the market. It is well known that such a representation would be looked upon as false, for the reason that the supply of oil of wintergreen is extremely small. A further investigation showed that a large proportion of the so-called oil of wintergreen consisted largely of mixtures of methyl salicylate and oil of sweet birch; for example, one of the manufacturers of so-called oil of wintergreen found it very difficult to explain certain circumstantial evidence, and finally admitted that the product he was selling as oil of wintergreen was in reality not that article. The investigation is still in progress, with the view to devising a method for detecting the various mixtures of the three commodities known as oil of wintergreen, oil of sweet birch, and methyl salicylate.

[a] The words "morphin" and "cocain" as used in this report refer to the salts of the respective alkaloids.

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Peppermint oil undoubtedly constitutes one of the most important industries in essential oils in the United States. Investigations are in progress to determine whether or not one variety of plant grown under varying conditions would produce oils superior to those made from another variety grown under similar conditions, and whether or not the oils so produced comply with the standard set by the Pharmacopœia. Quite a number of authentic oils were gathered in southern Michigan, but no conclusions have been reached as yet. A sample of California peppermint oil was also procured and was found to contain an unduly large amount of menthol. Other oils under investigation are spearmint, tansy, and wormwood.

The quantitative methods for determining the chief odor-bearing constituents are being studied. These methods involve the determination of many of the ketones and aldehydes present in the various essential oils. A special study of the hydroxylamin titration method for estimating ketones and aldehydes is in progress in order to determine whether or not this method is more generally applicable and reliable than the alkaline sulphite or bisulphite solutions at present used. Many of the ketones do not react with the sulphite solutions. From the results obtained so far it is apparent that this method when carefully worked out will give closely concordant results in the hands of different workers, and in most cases the product of the reaction can be recovered and its chemical identity established. The method has already been compared with the other assay methods in conjunction with spearmint and dill oils. The method also promises well for determining the quality of such oils as tansy, wormwood, pennyroyal, and dill, for which at present there is no satisfactory method of assay. The official method for determining the presence of dimethyl sulphid in oil of peppermint as prescribed by the United States Pharmacopœia is also under investigation.

The analysis of certain brands of root-beer extracts on the market having revealed the presence of a considerable quantity of free salicylic acid, the question of the hydrolysis of methyl salicylate under the conditions obtaining in the manufacture was raised and it became necessary to establish whether the salicylic acid found is added as a preservative or whether it is the result of hydrolysis of methyl salicylate. The indications point to the latter hypothesis as the correct one, in which case salicylic acid may appear in the finished product without having been added as such.

The interstate samples of essential oils so far examined show that they are either pure or the variation from the standard prescribed by the Pharmacopœia is very slight. In many instances, however, the oils are evasively labeled with such phrases as "for technical use only" or "not for medicinal use."

SYNTHETIC PRODUCTS.

In former years it was customary for manufacturers of proprietary remedies, particularly those for headache, rheumatism, and la grippe, to represent them as containing drugs of exceptional curative powers, while, as a matter of fact, the active ingredients were usually acetanilid, antipyrin, some salicylate, with frequently caffein and quinin. A marked change has taken place under the operation of

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the food and drugs act in that such common and active synthetics as acetanilid and acetphenetidin must be properly declared on the label, so that it becomes apparent at once to the consumer how much of these drugs he is taking at each dose. During the past fiscal year the Synthetic Products Laboratory has examined 252 interstate and 12 unofficial samples; 72 of the former were reported as illegal, and 15 notices of judgment dealing with such materials have been issued. The illegal samples included preparations for the treatment of headache, neuralgia, la grippe, rheumatism, and catarrh, and contained among other constituents various synthetics, such as acetanilid, acetphenetidin, antipyrin, salicylic acid, salol, heroin, codein, and novocain. Several products, such as soft drinks and Haarlem oil, were subjected to check analysis in this laboratory for the purpose of verifying the amounts of cocain, caffein, and methyl salicylate originally reported.

The investigations inaugurated in 1908 for the purpose of developing methods for estimating the constituents present in headache mixtures were continued during the past year. Very satisfactory results were obtained with the new method for separating acetanilid from acetphenetidin. Sophistication of the latter product with acetanilid can now be quite accurately determined, both volumetrically and gravimetrically, by means of the iodin addition product of acetphenetidin. A method has also been elaborated for the purpose of separating and estimating antipyrin and caffein in mixtures. The efficacy of these methods was clearly shown in the examination of various check and interstate samples. Further work has been accomplished in the recovery of caffein from certain animal tissues and secretions, particularly the bile.

COOPERATION WITH POST-OFFICE DEPARTMENT.

The Division of Drugs has continued to cooperate with the Post-Office Department in its efforts to obtain fraud orders against medicinal agents represented as cures for various maladies sent or prescribed through the mails in violation of the postal laws. To this end the analysis of the samples of medicines used is supplemented by a study of all of the claims and representations made for the treatments. The number of remedies in each treatment varied from one to ten. Twenty of these treatments were investigated, eight of which were so-called "cancer cures." One of these consisted essentially of cloth bags containing a mixture of about 98 per cent of sand and clay and 2 per cent of boneblack. It was represented that these "cancer absorbents" would cure cancer completely and permanently by withdrawing or absorbing the "cancer poison" from the system. "Cancer tablets," to "soften and dissolve the growth from the inside," and "cancer ointments" were also employed in conjunction with them. The tablets were found to consist of 98.4 per cent of sugar of milk, 1.4 per cent of moisture, and a trace of animal charcoal and an excipient; the ointment was composed of petroleum mixed with oil of tar and a trace of vegetable matter. Another, comprising seven remedies, consisted essentially of potassium iodid, and from the evidence presented at the hearing it was clear that, like many other "cures" of this class, it was in reality directed toward the

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relief of syphilitic troubles erroneously believed to be of a cancerous nature. The Post-Office Department has issued fraud orders in nearly a dozen of these cases, and as a result the mail-order "cancer-cure" business has, to a very large extent, been suppressed in this country. Other treatments investigated included epilepsy and hernia "cures," lost-manhood restorers, "cures" for women's ills, etc. There are several other cancer "cure" treatments of lesser importance under investigation, besides tuberculosis and epilepsy "cures," eyesight and vitality restorers, and similar remedies, all plainly of a fraudulent character.

Most of the "epilepsy cures" are prescribed and sold through the mails though a few of them are sold in the open market. They rank second only to the cancer cures in the misleading and deceptive character of the claims made for them. Most of them are represented to cure epilepsy, irrespective of kind or cause, completely and permanently, and the claims to this effect generally appear in the correspondence and printed matter sent to the prospective purchaser through the mail; only a few, if any, appear on the label. The representations commonly made are to the effect that as a result of the use of the treatment the epileptic seizures are lessened in frequency and severity, any diseased condition of the brain is corrected, and brain tissue which has been damaged or destroyed is replaced; this change goes on steadily until the whole nervous system is restored to a sound and normal condition, and, the cause being removed, the convulsive seizures no longer make their appearance and the epilepsy is cured, never to return. Such claims are false and misleading in the highest degree. The medical profession knows of no substance or mixture of substances which is capable of creating new brain or nerve tissue in place of the old which has been removed or destroyed. Most of the epilepsy cures depend for their efficacy upon the presence of one or more of the bromids. While these agents appear in some instances to exert a palliative effect upon the epileptic seizures, their effect is temporary only, and according to the best authorities they can not in any sense be considered cures for the disease.

"Consumption cures" are also sold through the mails as well as in the shops. Analysis in the Division of Drugs has shown that they usually contain ordinary medicinal agents, some of which are occasionally useful in combating the distressing symptoms of the disease; but so far as has yet been learned, their effect is temporary only, and they can not in any sense be regarded as "cures" for tuberculosis. Some of these remedies are represented to be cures and absolute cures for all forms of tuberculosis. Symptom blanks are employed in connection with these treatments as well as in connection with those cancer and epilepsy cures which are prescribed or sold through the mails, but this method of making a diagnosis in the absence of the patient is in such cases virtually worthless. Millions of dollars are spent annually to retard the progress of consumption, but it is well known that there is at the present time no specific for its treatment. Anyone engaged in exploiting a so-called consumption cure is simply trafficking in the life and health of the people, since the time lost in such a way may result in the death of the victims by delaying the use of the proper hygienic measures.

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MEDICATED SOFT DRINKS.

In the summer of 1907 an investigation was begun with the view of determining the number of medicated soft drinks containing either cocain or caffein or both. Since that time over 100 brands have been found containing smaller or greater quantities of caffein, and approximately one-third were found to contain small quantities of cocain. During the past fiscal year 15 samples, representing mostly new brands, were examined, all of which contained caffein and 6 contained small quantities of cocain. The amount of cocain, to be sure, was small in each case, but the presence of such a deleterious agent, sold without restraint to children as well as adults, must be considered a very undesirable practice which brings harm to all consumers. It is not uncommon to find persons addicted to the use of these drinks, especially factory employees, stenographers, typewriters, and others subjected to mental or nervous strain, many of whom, it is reported, spend a large part of their earnings for these drinks. Life insurance companies are considering the status of soft-drink habitués as future risks, and undoubtedly very small quantities of cocain affect the nervous system of many individuals, especially those who have been addicted to the drug habit. Even in the few instances in which the quantity of cocain present is declared upon the container, this information does not come to the attention of the public. During the year a farmers' bulletin (No. 393) on habit-forming agents has been published for the purpose of warning people in general against all beverages and remedies containing such materials, and explaining the menace that they bear to the public health.

SO-CALLED DRUG-ADDICTION CURES.

At the beginning of the last fiscal year the division was in communication with 35 institutions, combinations, or individuals engaged in the practice of treating drug addiction, opium, morphin, and cocain addiction, by furnishing treatment with instructions. As a rule the preparations contain, in large quantities, the very drug for which the treatment is to be taken. They are sent indiscriminately into any home, without any warning whatever relative to their poisonous character. Some of the promoters themselves have little knowledge of the dangerous character of the mixtures they are handling. For example, one of these treatments was found to be handled by a groceryman who had neither medical nor pharmaceutical knowledge, but distributed several treatments to anyone asking for them. Physicians very well understand that there are at present no substances known to the medical profession which can be used successfully for the treatment of drug addiction without the careful supervision and restraining influence of the doctor himself and the constant attendance of a nurse. It is also well known that drug addicts are incapable of curing themselves. The chief object of these treatments appears to be to extract money from the unfortunate victims, as is indicated by the fact that in some instances the treatment is supplied to the same individual over a period of years. A number of cases against products of this character are pending, but these dangerous commodities continue to be sent through the mails and especially by express from one State to another.

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PRESCRIPTION REMEDIES.

These prescription remedies usually call for several well-known medicinal agents, together with a coined-name product in the exploitation of which the advertiser is interested. In order to fill this so-called prescription it is necessary to purchase the agent sold under the coined name. The number of these remedies has been materially increased during the past year. Analysis reveals the fact that they are composed of well-known simple medicinal agents, and the claims made for them are not in keeping with the facts. The introduction of these mixtures has led to another scheme that might be called "household prescription remedies." They are advertised and sold in the same manner as are those just described, except that the purchaser himself supplies the ingredients necessary to compound the prescription. For example, in the manufacture of a face lotion, the prospective patient is advised to purchase a cheap well-known product under a coined name, mix it at home with certain well-known household agents, among them water, and apply the resulting mixture. The same directions are given for so-called shampoos, obesity reducers, and other remedies. The mixtures sold under these trade names are usually among the cheapest available on the market. For example, a certain commodity represented as a face lotion consists essentially of magnesium sulphate colored and perfumed. The amount of magnesium sulphate present in the package is worth less than 1 cent, but the package costs 50 cents. A shampoo exploited under a trade name sells for 75 cents, but consists essentially of borax, the amount contained in the package costing less than 5 cents. These are representative of a large number of products of this type at present on the market. It is of interest to note that these mixtures are sometimes exploited through the "Beauty" departments of certain newspapers. Such commodities are plainly unmitigated frauds.

PHARMACOLOGICAL INVESTIGATIONS.

STUDIES ON FLOUR AND NITRITES.—Additional experiments on blood pressure of cats and dogs were made with alcoholic and aqueous extracts of unbleached flour and of flour bleached by varying quantities of nitrogen peroxid. The results obtained indicate a fall of blood pressure in all cases, equal in degree, however, for the bleached and unbleached flours. In experiments with sodium and potassium nitrite, a fall of blood pressure was obtained in cats and dogs under ether anæsthesia when relatively small quantities were injected directly into the circulation. The effect of bleached flour on enzyms has been studied as follows: (1) Experiments on autolysis (self-digestion without foreign bacteria) of bleached and unbleached flour have been conducted, but no difference in the rate of autolysis has been observed; (2) artificial digestion experiments were made on gluten from unbleached flour and that bleached by different amounts of nitrogen peroxid. No conclusion could be reached as to difference in the digestibility of the wet glutens examined, but when the gluten was dried and powdered the digestion was somewhat retarded in some of the samples of bleached flour studied as compared with those obtained from unbleached flour; (3) the effect of nitrites on the salivary digestion of starch was studied, but, although moderately large amounts of sodium nitrite were used, no effect was noticed.

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STUDIES ON THE PHARMACOLOGY OF CAFFEIN.—(1) The experiments on the comparative toxicity of caffein in different species of animals and by different modes of administration were continued. Chronic caffein intoxication in dogs and rabbits was also studied.

(2) Experiments on rabbits to determine the production of caffein glycosuria indicate that doses not large enough to induce nervous and muscular symptoms cause a temporary diabetes. After larger doses the amount of sugar in the urine is increased. Glycosuria was also produced in some, but not in all, of the cats under observation. The amount of sugar in the urine of cats was much larger, however, than in that of rabbits similarly treated. It was also found that calcium chlorid stimulates caffein glycosuria in rabbits.

(3) Caffein added to liver tissue and allowed to stand in the presence of antiseptics for several days may be almost completely recovered, thus showing that the liver does not contain any specific enzym which destroys caffein.

(4) The elimination of caffein in the bile was studied in dogs, rabbits, and cats, results showing that caffein is eliminated through this channel.

(5) The effect of caffein on protein metabolism in dogs has been studied with especial care during the past year. Valuable and interesting data have already been obtained, and the work will be continued.

(6) A study of the effect of caffein on the circulation of cats and dogs is in progress.

(7) The elimination of kreatin and kreatinin after the administration of caffein has been continued. The results indicate increasing eliminiation of kreatin, but the evidence is not yet conclusive.

TOXICITY OF THE ALCOHOLS AND OF OTHER COMPOUNDS IN THE FATTY ACID SERIES.—Experiments on the comparative toxicity of ethyl and amyl alcohol were conducted, considerable work being done on the effect of ethyl alcohol on the protein metabolism in dogs. Because of its use in the arts and in flavoring essences for food, the pharmacology of amyl acetate was made the subject of a special investigation. It was found that from 4 to 6 cc injected subcutaneously caused paralysis and coma in frogs.

Some work has been done on the improvement of methods of analysis employed in metabolism experiments. The preparation of the sample for the determination of total nitrogen in feces and the determination of allantoin in the urine of animals have been especially studied and improvements made in the usual procedures.

CHEMICAL REAGENTS.

Five hundred and three chemicals were examined to check the quality of the reagents supplied to the Bureau of Chemistry and the branch laboratories on contract, as well as to other laboratories of the Department. Some improvements have been made in the general quality of the chemicals during the past year, and in many instances the manufacturers have improved on the style of container and the method of labeling. The rejections from the various lots of chemicals has been about 5 per cent. Some of the rejections and the reasons for same are as follows: Absolute ether, containing peroxids; absolute alcohol, containing foreign organic matter and aldehydes; citric acid,

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containing sulphates; hydrogen peroxid, U. S. P., found to contain acetanilid; lead peroxid, labeled c. p., found to contain 5 per cent of lead sulphate.

Manufacturers have expressed not only in words, but in action, a marked degree of willingness to supply the character of chemicals needed for the analytical work of the Bureau. Difficulties relative to procuring acetic acid complying with the sulphuric acid-bichromate test have been experienced during this year, as in the past. This is largely because of the fact that the awards are made to different dealers from year to year, and each one in turn has the task of providing an acid of suitable quality or enlisting some manufacturer to produce a reagent of proper quality.

The investigation relative to the quality of the various glacial phosphoric acids on the market has been completed and the results compiled. They clearly show that the various brands of this product are variable mixtures of meta-phosphoric, pyro-phosphoric, and ortho-phosphoric acids, together with smaller or larger quantities of sodium phosphate. The latter is usually added for the purpose of causing solidification and thus enabling the manufacturer to supply an article of attractive appearance and which can be readily handled. It was also found that solutions of glacial phosphoric acid reverted from the lower hydrated acids continuously, and the rapidity of such reversions depend on temperature, concentration, and the nature of associated substances. It can therefore readily be seen that a mixture of such variable composition is an undesirable chemical reagent. It is further evident, in view of the fact that solutions of glacial phosphoric acid are never constant in composition, that such should not be used in the manufacture of medicines to be employed in the compounding of prescriptions. The reversion was proven to take place not only in the commercial brands, but also in meta-phosphoric acid made in the laboratory and of known purity.

SPECIAL INVESTIGATIONS.

VEGETABLE PHYSIOLOGICAL CHEMISTRY.

As in former years, the investigations in plant physiological chemistry, under the direction of J. A. Le Clerc, have been performed to a large extent in collaboration with the various offices of the Bureau of Plant Industry. For example—

(*a*) Studies of cereals for the Office of Grain Investigation and the Office of Grain Standardization, to determine their nutritive value when grown under different conditions and to determine the localities best adapted for the production of the particular cereals in question.

(*b*) Baking studies for the Office of Grain Investigation, in testing the value of Maryland flours, which for a number of years had been selected, crossed, and grown at College Park. This series of tests was for the purpose of eliminating the least desirable varieties of wheat under experimentation.

(*c*) The analyses of wheat to test the effect of varying amounts of shade on the protein and starch content, in collaboration with the physicist of the Bureau of Plant Industry.

(*d*) Acidity studies of peat for the botanist in connection with the blueberry investigation. These results are of value in indicating

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whether the peat in question is suitable for growing blueberries and how to adapt unsatisfactory peat to this purpose.

(*e*) Barley investigation in collaboration with the barley experts of the Bureau of Plant Industry. This experiment was started for the purpose of noting the changes in composition of many varieties of barley when grown at the same experiment farm for a series of years.

(*f*) The study of alkali extracts in collaboration with the Office of Alkali and Drought-Resisting Plants and the Office of Western Agriculture Extension to determine whether the solutions in question contained sufficient alkali to prevent the growth of crops in the localities affected.

(*g*) The study of the absorption of plant foods by plants grown in the Great Plains area, in collaboration with the Office of Dry Land Agriculture. This is only a small part of the work done in connection with a very extensive project begun by the Bureau of Plant Industry to determine the influence of crop rotation. The chemical work includes the determination of the plant food taken up by plants grown under the different conditions.

Besides these collaborative studies, this laboratory milled 323 samples of wheat, obtained through the ordinary commercial channels, in order to prepare them for the determination of the amount of nitrites naturally found in flours as a preliminary to the bleached-flour investigation.

Other studies have included:

(*a*) Baking experiments to determine the value of high-protein food materials as partial substitutes for flour in bread making. The results thus far obtained promise to afford a cheaper loaf of bread, which shall be both nutritious and palatable.

(*b*) The influence of environment on the composition of wheat. This study has shown that environment has a greater influence in affecting the composition than has variety and the results have been published as Bulletin No. 128.

(*c*) The composition of cereals at different stages of growth, in order to determine when the plant should be cut in order to yield the most nutriment. This experiment is being carried on in collaboration with the Office of Grain Investigation, and the work is mostly with barley and wheat.

(*d*) Changes in the composition of cereals during storage. The results thus far obtained show that corn changes in composition very much more rapidly than do the other cereals.

(*e*) The study of the composition of barley and malt. The object of this study is to note the changes which take place on malting and to study the best temperature at which malting and subsequent kilning should be conducted with a view to causing the least possible loss and of producing a malt with the highest diastatic power.

(*f*) The effect of soil exchange (between Kansas, California, and Maryland) on the composition of wheat. This is intended to supplement the tri-local experiments on environment in order to determine to what extent the differences in composition found are due to the variations in soil. The first year's results only are at hand and they would seem to indicate that somewhat better crops can be produced on the California and Kansas soils in all three localities than on the Maryland soil. The differences in composition are, however, not

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nearly so great as that caused by the change due to environment even on the same soil.

(*g*) The study of the form in which phosphorus occurs in wheat and cotton-seed meal. As it was intended to use cotton-seed meal for bread-making purposes, it was thought desirable to determine the nature of the phosphorus compounds found therein.

(*h*) The study of the translocation of plant food and the elaboration of plant material during germination and during the early stages of plant growth. Such studies have been carried on in the past with respect to maturing plants. This study takes up the first two weeks of the plant's life, and the results obtained are expected to be of considerable interest to scientific and practical agriculture.

In the conduct of this work, approximately 11,000 chemical determinations were made, and over 3,000 other examinations, including milling and baking tests, fermentation tests, physical tests of cereals, and granulation tests on flour.

ANIMAL PHYSIOLOGICAL CHEMISTRY.

A preliminary feeding experiment on animals to compare the relative nutritive values of glucose and cane sugar was completed. This study has not extended over a sufficient length of time, however, to be conclusive, though the results so far obtained indicate that the animals did not thrive so well on glucose as on cane sugar.

Analyses of yeast and beef extracts of known origin and a study on the determination of glycerin in medicinal meat preparations were made.

The work on the deterioration of meats and fish has been continued and is nearing completion. So far the results show that incipient deterioration of meats and fish when kept at low temperatures for periods of six to eight months can be detected by chemical means. The scope of the study has been enlarged in order to determine how long such products should be held in storage, especially with reference to their fitness for food under the food law.

Progress has been made during the past year in a study of the enzyms which accomplish the digestion of sugars in plants and animals. The laws of the action of one of the most important enzyms, invertase, have been reduced to exact knowledge by accurate quantitative study, and from this investigation there has resulted a useful method for estimating cane sugar in agricultural products. By the use of this new method it has been found that a wild plant, which occurs abundantly in Texas and New Mexico, called sotol (*Dasylirion texanum*), contains 13 per cent of the important sugar fructose. It is planned to examine other related plants by this method. The results of these researches have been published in circular form. There is in progress a study of the enzyms maltose and emulsin, which has for its purpose the development of a method of analysis for the sugars maltose and raffinose. As these enzyms can not in general be employed with certainty in chemical analysis until the laws of their action are fully known, it is necessary to make first a careful scientific study of their properties.

An important investigation arising under the food law was made to determine the value of a so-called "diabetic flour." The excretion of sugar was doubled on feeding a diabetic with a limited quantity of

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bread made from this flour, showing that the claim made for it was entirely without foundation.

Approximately 300 samples were analyzed in the prosecution of these studies, from three to five determinations being made on each one. This work is done under the direction of F. C. Weber.

MICROCHEMICAL INVESTIGATIONS.

Micro-analysis is of increasing importance both in the routine examination of food and drug samples under the law and in making researches for the solution of problems in connection therewith. Much collaborative work with other laboratories of the Bureau and Department, and some for other branches of the Government service, is done to supplement other examinations. During the year the following investigations under the direction of B. J. Howard have been carried on and are at present in varying stages of completion, the fig and egg investigations being made in collaboration with the Bacteriologist.

FIGS.—The condition of figs imported into this country has required an extensive and thorough study to determine the actual condition of the output as a whole, as well as to perform the routine work in the examination of individual samples. An extended inspection was made at the port of New York at the time of the fall importations to ascertain the condition of the new crop as unloaded at the docks and to collect numerous representative samples of the different grades for more careful laboratory inspection. This examinatnon consisted in sorting each sample according to the percentage of figs containing (1) live or dead worms, (2) worm excreta, (3) sugar mites, and (4) molds. In order to identify these it was necessary to study the life history of the so-called worms (larvæ) which were allowed to develop in sterile figs, the resulting moth laying her eggs, and the whole cycle was thus followed.

DESICCATED EGGS.—The egg investigations, begun three or four years ago, have been continued, especially concerning frozen and desiccated products, with a view to detecting inferior materials when used in these goods. Experiments have been conducted on perfectly sound eggs, also on various grades of spoiled eggs, studying the products under different conditions and thereby determining what changes may legitimately be expected to take place in these products. This work was supplemented by a thorough inspection of Eastern factories during 1909, which inspection has been extended to about 25 factories of the Middle West during the present year. The kind of material used and the conditions of sanitation under which they were handled were the primary considerations, though every step of the process from candling to the finishing of the product was followed and samples taken for bacteriological and microscopical examination. As frozen and desiccated eggs are extensively used by the bakers of this country and are said to be an important channel for the utilization of the surplus material available in the spring and summer, it is apparent that the product should be carefully prepared from fresh material.

MISCELLANEOUS.—New studies have also been made concerning the conditions of manufacture of ketchup and the causes of certain

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forms of spoilage. This work was especially needed to furnish data for passing on samples submitted for examination under the law, the microscope furnishing evidence as to the condition of the raw material which chemistry unaided could not supply.

The work on mustards has been continued and that on charlock is nearly completed. The importance of this weed as a substitute for mustard has led to the examination of a considerable number of commercial samples to determine the prevalence of this product on the market.

The condition of olives imported into this country was also investigated, the examinations showing that certain grades are very liable to be in a wormy condition, the worms having developed in the fruit previous to packing; apparently this fruit was sorted out as a low-grade product.

Much preliminary work has also been done on the application of microscopical methods to quantitative determinations. The work on alkaloids embraces now the study of 66 different kinds, and has yielded very gratifying results in its application to the identification of some of these products.

Paper samples have been examined during the past year for the Government Printing Office, General Supply Committee, Post-Office Department, and Bureau of Engraving and Printing, and floor coverings also for the General Supply Committee. Among the miscellaneous samples examined should also be mentioned paint pigments, carpet samples for a determination of the kind of fiber used, and samples of bone ash and cream thickeners.

The samples examined in connection with the food and drugs act include nearly 1,300 specimens, and among these are included ketchups, eggs, fruit products, olives, cattle foods, cotton-seed meal. Most of the drugs examined have been imported samples. A classified list of the various samples reported during the year is as follows:

General samples:	
Papers	2,735
General food samples	602
Stock foods	85
Pigments	32
Drugs	107
Unclassified	371
Total	3,932
Interstate samples:	
Foods	764
Stock foods	332
Drugs	164
Total	1,260
Sum total	5,192

ENOLOGICAL CHEMICAL RESEARCH.

GRAPE AND APPLE INVESTIGATIONS AT SANDUSKY, OHIO.—The enological chemical research, conducted by William B. Alwood at Charlottesville, Va., has followed in general the plan of previous years, but the amount of field work done has been greatly increased. It was found necessary in order to study thoroughly the grape crop used

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in the manufacture of fruit juices and fermented by-products to establish a temporary laboratory in the northern grape belt. This laboratory, for convenience of access to the crop, as well as to the large manufactories, was placed at Sandusky, Ohio, and has been in operation practically throughout the fiscal year. The greater part of the work consisted in the chemical examination of the grape crop and by-products to determine the sugars, acids, and other important elements, 624 samples being analyzed. Four hundred and fifty-three samples of apples and their by-products were also examined, a total of 1,077 samples of fruits and fruit products analyzed at the Sandusky laboratory and involving above 8,000 determinations. This work has furnished a large amount of important data, which will have much value for reference and eventually aid in establishing the facts as to the proper composition of these products.

In connection with the study of the fruits, both grapes and apples, as presented for the manufacture of by-products, a number of fermented products were made in the laboratory in sufficient quantities to furnish full chemical data on all stages of the entire process of manufacture and on the finished article. As this work is especially designed to supply data for use in the administration of the food law, various methods of sophisticating fruit products were applied, and the chemical history of the product was carefully determined.

This investigation is now well under way, but several years will be required to complete the work so as to give reliable data, which shall cover the variations in the composition of the fruit from year to year.

COMPOSITION OF COMMERCIAL CIDERS AND WINES AND OF THOSE OF KNOWN HISTORY.—At the main laboratory at Charlottesville the chemical investigation of the composition of pure wines and ciders of known history has gone steadily forward. There are now under observation 62 wines made under strict control, including samples from most of the important varieties of grapes used for this purpose in the eastern United States. Ten samples of ciders are under observation, especially as to the effect on quality of different methods of storage. These have been so made and handled that both the manufacturing data and the chemical history are on record, and will furnish indisputable testimony as to what can be made from the fruits used.

The systematic collection and examination of the commercial wines and ciders of the eastern United States has been carried forward as rapidly as the conditions would permit. This work must of necessity give place to the investigations on the fruit crop and the manufacture of samples therefrom in season, but it is now approaching a state of completion when a large amount of data will be available. The past year 133 samples of these beverages have been examined, and a considerable stock is still awaiting attention. Previous work on commercial wines included 183 samples; thus data on 316 samples have been accumulated.

The total number of samples examined at the Charlottesville laboratory during the fiscal year was 597, or about 5,000 determinations, on fruit samples and by-products. Thus the total number of samples handled in the two laboratories reached 1,674, and the determinations made during the fiscal year exceeded 13,000.

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YEAST RACES.—The attention required by the field work has rendered it necessary to defer, in a large measure, the critical studies on yeast races, which has been under way for several years, but this work is in hand and will be carried to completion. The demands for cultures of the yeast races already determined as having superior value continues, and small cultures for use as starters are furnished to manufacturers on request, and also to other laboratories. This distribution of cultures with instructions for their use is materially aiding in the improvement of the technic in the fermentation industries. The chemical and biological work of this section is now housed in the new laboratory at Stonehenge, Charlottesville, which furnishes an opportunity to increase the volume of work and improve the technic as well.

DENATURED-ALCOHOL INVESTIGATIONS.

During the past year the course of instruction in practical distillery work and lectures on the different phases of the manufacture of denatured alcohol, begun in 1909, were repeated, especial attention being given to the practical side of distillery operation. Besides the general educational work, experiments were conducted to determine the best methods of handling potatoes, using the American types of mashing and distilling machinery. The results obtained were eminently satisfactory, it being shown that potatoes could be satisfactorily handled in the American type of cooker and with good results.

Experiments were made also in the preparation of cheap malt, as this is one of the most expensive distillery materials that would ordinarily be purchased by the small distiller. It was found that a very satisfactory and cheap malt could readily be prepared on a small scale which would result in a very appreciable saving in the cost of operation. Even in so small a distillery as the experimental one used by the Department from $2 to $3 per day were saved by the use of green malt prepared at the distillery instead of the dried distiller's malt of commerce. Extensive analyses of the various products of the distillery were made, and all the results of the investigation were incorporated in Farmers' Bulletin 410, entitled "Potato Culls as a Source of Industrial Alcohol," with a general discussion of the availability of other wastes.

FOOD AND DRUG INSPECTION.

While nearly every division of the Bureau cooperates to some extent in either the food or drug work, the collection and examination of official samples of foods and drugs is assigned primarily to the inspection force of forty men under the chief inspector, with headquarters at Washington; to twenty-one branch laboratories, located throughout the country, and including one at Honolulu; and two inspection laboratories at Washington which check the analytical work of the branch laboratories on foods and drugs, respectively, and make original examinations of the samples collected in the vicinity of Washington. The official samples on flavoring extracts, dairy products, stock feeds, grains, and waters, however, are referred to the specific laboratories charged with the analysis of such materials, namely, the Food Technology Laboratory, the Dairy Laboratory, and the appropriate laboratories of the Miscellaneous Division. All of

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the analytical reports of the branch food and drug inspection laboratories on official samples are referred to the specified laboratories for checking, and the preliminary selection of cases is made, the same being then prepared for the consideration of the Chief of the Bureau. In addition to their work in the examination of samples and the preparation of cases, these laboratories are conducting many special investigations to secure information necessary to the enforcement of the food and drugs act.

Several classes of food products are referred to other laboratories in the Bureau of Chemistry for the expert opinion of specialists on the questions involved. Among these may be especially mentioned the Sugar Laboratory, which examines all samples of sugar and saccharine foods; the Oil, Fat, and Wax Laboratory, which devotes its attention especially to the examination of those products; the Microchemical and the Bacteriological laboratories, in which all examinations are made of this nature; and the Leather and Paper Laboratory, to which samples of turpentine are referred. Such special reports are made to the laboratory which has charge of the preparation of the case, as just defined.

WORK OF THE INSPECTION FORCE.

CHANGES IN THE FORCE.—The general operations of the inspection corps along the lines laid down at the conclusion of the last fiscal year were seriously interrupted by the development of important special investigations and the amount of time spent by inspectors as witnesses in cases which had been referred for prosecution. There has been no increase in the number of inspectors, but a few changes have been made in the personnel of the force, due to four resignations and one death during the past year. Necessary appointments have been made, however, to fill these vacancies, and the quota of forty inspectors is now complete. Two inspectors are stationed at St. Louis and Philadelphia in order to handle to better advantage the volume of work which has constantly demanded attention at these trade centers. New stations have also been established at Cleveland, Ohio, and Springfield, Mass., necessitating the withdrawal of one inspector from Cincinnati and the abandonment of the station at Albany, N. Y. This work is in charge of W. G. Campbell, chief inspector.

COLLECTION OF SAMPLES.—The experience gained during the two years since the inception of the inspection work has shown that the most effective way of maintaining supervision over the interstate traffic in food and drug products is to visit the establishments where such commodities are prepared, to note the conveyance of the several classes of goods by the different carrier lines engaged in interstate commerce, and to collect specimens of both manufactured and crude products for analysis. A résumé of the routine work performed shows that a total of over 11,500 samples were thus obtained. This includes official samples, which may serve as the basis for prosecution of manufacturers or shippers, provided there is indicated any violation of the law, and also such samples as were collected for information or research which do not meet the legal requirements of official samples, but, nevertheless, serve the useful purpose of disclosing the nature of goods and the tendencies of their producers to meet or

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evade the requirements of the law. The number of factories inspected is somewhat over 1,600. This, however, does not include the special inspection of manufacturing establishments which may have been perfunctory in their nature and yet thorough enough to yield the information desired.

SPECIAL INVESTIGATIONS.—Of the special investigations undertaken the last year, either by the inspection force alone or in conjunction with the chemical force, probably the most important, and the one which required the efforts of the largest number of inspectors over protracted periods, was the bleached flour campaign inaugurated to restrict interstate traffic in flour which had been bleached with nitrogen peroxid. The work was divided into two periods and carried on during the summer and autumn of 1909 and the spring of 1910. It was found impracticable to collect and deliver samples of all the interstate shipments located to the laboratories for examination, therefore the inspectors were provided with reagents to make preliminary examinations of samples of such flour, and if it appeared that the product had been bleached, a sample was forwarded to the laboratory and a check analysis made. A number of seizures were made in various sections of the country, and the preparation of the evidence necessary for the prosecution of these cases required an inspection of practically all of the mills in the Middle West and Northwest engaged in bleaching their output. Two cases have been tried, one at New Orleans, La., and the other at Kansas City, Mo., the former before a commissioner and court and the latter before a jury. In both instances decisions were rendered in favor of the Government.

Another important investigation related to interstate traffic in desiccated and frozen liquid egg products. This class of material is used exclusively in foodstuffs produced in wholesale quantities, and the consumer is thereby deprived of the opportunity to judge of its actual character before it is mixed with other substances and subjected to the process of baking and cooking. Necessary factory inspections and vigilant supervision of interstate shipments led to the institution of a number of criminal prosecutions and the confiscation of shipments on the charge of adulteration due to the contaminated or filthy character of the product. Several tons of eggs in both liquid and dry form have been confiscated and, under order of the courts, destroyed.

Another matter which has received considerable attention is the investigation conducted in connection with the Food Division as to the manufacture of cider vinegar. This was very comprehensive, involving a great many inspections and the collection of authentic samples in the States of Massachusetts, New York, New Jersey, Ohio, Michigan, Illinois, Iowa, Missouri, and Arkansas.

The inspection begun last year of the shipment of citrus fruit from certain districts in Florida has been continued, with special reference to the practices of some growers in shipping their crops to northern and eastern markets in an immature condition, where the fruit is subsequently treated by artificial means to bring about the appearance of a well ripened and mature product.

In collaboration with the Enological Laboratory, some work has been done in regard to the wine industry in northern Ohio, not only for the purpose of detecting instances of violations, but also to secure

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the necessary data as to the grades of wine that may be produced in that section and to verify or disprove claims made by the manufacturers. Reports have also been made by inspectors, as the result of extensive inquiry, concerning the conditions under which food products are kept in cold storage in the principal trade centers.

The work begun the previous fiscal year in connection with the Sugar Laboratory was continued, samples of maple sugars and of maple sirups being procured at the source of production in the maple camps throughout Ohio, West Virginia, New York, and Vermont.

Another inspection which was continued was that of the conditions surrounding the soaking and floating of oysters and clams, and wherever instances of violations of the law were discovered samples were collected and shipments reported for seizure.

The investigation of the bleaching of oats and barley with sulphur fumes to improve the appearance of these cereals and the general practice of adulteration of cattle foods, supplemented by the collection of a great many official samples in various States, was continued.

The inspectors also cooperated in the concerted campaigns instituted to ascertain the character and quality of milk delivered in interstate shipments at Boston and Springfield, Mass., and at Cincinnati, Ohio.

At the request of certain packers of sardines along the Maine coast, an investigation was undertaken for the purpose of ascertaining the conditions under which these fish were canned, especially with regard to the sanitary features. One of the results of the investigation thus far has been to report shipments of old goods which were seized and destroyed because of adulteration with tin salts.

The varied character of the work performed by the inspectors is illustrated by enumerating other investigations in which they cooperated: The investigation of methods of manufacture and the collection of authentic samples of essential oils; an inquiry in collaboration with the Dairy Division of the Bureau of Animal Industry of the condensed-milk industry; an investigation to determine whether apples grown and shipped from the States of Oregon and Washington were misbranded in being labeled as the products of the Hood River districts; an inquiry into the practice of the firms engaged in producing salt in California and Utah and marketing it in imitation of well-known brands of English salt; and in numerous other special investigations which have been pursued at the request of state officials.

WASHINGTON FOOD INSPECTION LABORATORY.

The total number of samples examined in the Washington Food Inspection Laboratory during the year was 2,431, of which 790 were check samples of import foods taken at the various branch laboratories, 205 were import food samples taken in connection with the nonlaboratory port inspection in the Washington district, and 1,436 were samples of food of domestic origin. The preparation of the cases arising from these examinations forms a large part of the work of this laboratory, 1,600 cases having been prepared and submitted to the board for consideration.

The volume of work, both analytical and executive, handled in this laboratory restricts the researches, but several important studies have been made or supervised, notably the denatured alcohol investi-

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gation and the study of methods for the identification of colors used in food products.

Some specially interesting features of the imported food work during the year were as follows:

In order that import cases may be handled in as short a time as possible arrangements have been made with the Treasury Department to establish certain precedents, and when the adulteration or misbranding of imported foods fall under one of these the port laboratory is empowered to report its conclusions direct to the customs officials in charge at that port. A gradual extension of this list of established precedents has taken place, so that during the past year practically all of the cases were handled at the ports directly with the customs officials, only special cases or appeals from the action of the laboratory being referred to Washington for check examination and final action. It is the handling of these special cases and appeals which often requires special investigation and constitutes the greater part of the import work of the Washington Food Inspection Laboratory, where all recommendations to the Board of Food and Drug Inspection on imported foods are prepared.

The inspection of meat and meat food products, through the cooperation of the customs officials, has been extended to the ports where no laboratories or inspectors of this Bureau are stationed, so that now all of these products must be accompanied by proper meat-inspection certificates, showing that they have been examined before and after slaughter by an official veterinarian. In addition, through cooperation with the Bureau of Animal Industry, an actual inspection will be made of imported meats when it is necessary to determine whether they are in proper condition at the time of arrival.

The insanitary conditions surrounding the packing of imported figs having been brought to the attention of the Department, and a great many shipments of dried figs being refused entry at the various ports on this score, every manufacturer of figs was required to submit a sanitary certificate from the American consul showing that his factory was in a satisfactory condition before his goods were allowed entry. As a result, a very rapid betterment of conditions and methods of packing took place. It also developed that these figs were very largely wormy or worm-eaten or infested with sugar mites. As a result of this work foreign countries interested in the production of figs have been making strong efforts to better the conditions at home so as to meet the requirements of this country, and undoubtedly a much better grade of figs, packed in more sanitary surroundings, will be brought into the country in the future. The imported ripe olives were also found to be wormy or worm-eaten, many shipments consisting almost entirely of such imperfect fruit, necessitating reshipment.

The French Government limited the area in which Cognac brandy could be produced, and prohibited the labeling of any brandy produced in other parts of France as Cognac. The value of the word "Cognac" was so great, however, that practically all French brandies were labeled in such a manner as to convey the impression that they were made in that locality, the word "Cognac" appearing in very large type and other words restricting its application in very much smaller letters. Quite a number of shipments of brandy

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labeled in this manner were detained and required to be relabeled before entry. As a result, the labeling of these products has been changed, so that they no longer convey the impression that the product is made in Cognac when such is not the case.

It was also noted during the past year that certain kinds of canned fish contained excessive amounts of tin. Especially was this true of the kippered herring, smoked sardines in bouillon or tomato sauce, fish in mustard sauce, etc. In some cases nearly all the tin on the inside of the can would be dissolved and the product would contain from 5 to 8 grains of tin per pound. The corroded appearance of the inside of the can in such cases is readily noted. Many shipments of this class of products were refused entry, and it seems probable that the method of packing these goods must be changed. The examination of fish, sardines, etc., put up in oil shows that, as a rule, they do not contain tin to any extent, the oil acting as a protecting coating to the tin.

A survey of the work of the year shows that certain forms of adulteration common at the beginning of the inspection work are now exceedingly rare, such as the mixture of olive oil with other oils, for instance, only one sample being found thus adulterated. Cheeses made from skim milk are now generally properly labeled, and the use of boric and salicylic acids as preservatives has been practically eliminated, only one case being reported.

EXAMINATION OF DAIRY PRODUCTS UNDER THE LAW.

Of the dairy products entering into interstate commerce, special attention has been given to various brands of cheese of domestic origin labeled as a foreign article. Many instances of this form of misbranding have been brought to the attention of the manufacturer, and the necessary changes made in the labels. In one case where the label of an Austrian variety of cheese was made use of on a domestic product, the foreign label has been discarded entirely, while others have only modified the wording of their labels, substituting English for foreign words.

Consideration has also been given to the subject of short weights in the case of the American Cheddar variety of cheese. It appears to be the universal custom of the trade to pay for cheese on the basis of the marks of boxes, which represent the weights at the time of shipment from the factory; unless the consignee uses the precaution to reweigh or check these weights a considerable shortage is often shown, due to shrinkage while in storage. Improvement has been made in this form of misbranding, in that most consignments of cheese are reweighed at the time they enter interstate commerce. Considerable deception is still practiced in labeling whole milk cheese as "cream cheese." One company making a well-known variety has removed the word cream from their labels.

The examination of fresh marketed milk entering interstate commerce has been continued during the year. Milks marketed in Boston and Cincinnati were examined in collaboration with the inspection laboratories in the cities named. The adulteration of milk by watering for city consumption is found to be still prevalent, though a marked improvement from a chemical standpoint is noted in the

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case of Cincinnati milks, as compared with the previous investigation at this point.

An extensive investigation is in progress by the chief of the Dairy Laboratory, G. E. Patrick, of the manufacture of evaporated or condensed milk, for the purpose of determining reasonable limits of composition for this product. The investigation was ordered in consequence of numerous complaints from manufacturers, claiming that a total solids content of 28 per cent as at present required is unreasonably high, it being alleged to be impossible to attain such a standard at all seasons of the year and still produce a smooth, homogeneous, marketable product. This investigation necessitates a critical study of the manufacturing methods employed and results obtained in different parts of the United States.

A classified list of samples examined is as follows: Evaporated milks 159, cheese 112, fresh milks 54, butters 131, oleos 8, creams 15, condensed milks 33, milk powders 27, miscellaneous (malted milks, butter colors, ice-cream thickeners, etc.) 52; total 591. Of this total 357 were inspectors' samples, 49 were received from branch laboratories, 61 were examined in connection with the evaporated-milk investigation, and 97 were renovated butters examined for the Dairy Division, Bureau of Animal Industry. Cases recommended to the Board of Food and Drug Inspection for prosecution were as follows: Milks 83, cheese 66, evaporated milks 12, milk powders 7, butters 4, condensed milk 1, ice-cream thickeners 1; total 174.

WASHINGTON DRUG INSPECTION LABORATORY.

DOMESTIC DRUGS.—During the past year 994 samples of domestic drug products have been examined in the Washington Drug Inspection Laboratory, and 323 were found to be in violation of the law. In addition seizures of a number of consignments of drugs were recommended on the ground that they were either adulterated or misbranded under the law. Some of the analysts have devoted much time as witnesses at the trial of the cases.

The chief violations found were misrepresentations on the labels of bottle or carton and in the advertising literature accompanying the packages, and further incorrect statements, or the absence of any statement regarding the declaration of alcohol, opium, morphin, cocain, acetanilid, chloroform, etc. A considerable number of powdered drugs have been found adulterated, among which are belladonna leaves, containing an excessive amount of sand and foreign plant material; powdered colocynth, containing large amounts of seed; pilocarpus leaves, spurious or musty and worthless; spigelia, spurious or containing foreign plant and sand; stramonium leaves adulterated with foreign leaves, seed, and dirt. On the whole, however, the quality of powdered drugs was found to be better than in the preceding year, those from the Pacific Coast States being inferior to those collected in the East.

Examination of a number of so-called cancer and drug addiction cures have disclosed them to be of the same fraudulent character as previously, but a goodly number of these products have been taken off the market within the last year, or the labels and literature have been made to comply with the law.

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IMPORTED DRUGS.—Of the 228 samples of imported drugs analyzed in this laboratory, 201 were found to be illegal. But few shipments of crude drugs were included among these, however, the illegal samples consisting chiefly of proprietary remedies.

A large percentage of the imported drug products detained are disposed of by the port laboratories under precedents which have been established, but all cases for which there are no precedents are regularly referred to the Washington Drug Inspection Laboratory, together with the appeals from importers, shippers, or manufacturers for investigation and recommendation. The character of violations is very similar to those encountered in domestic drugs, namely, misrepresentations upon the label, carton, and in the accompanying literature, regarding the medicinal claims, names, place of manufacture, etc., and the absence of or the incorrect declaration of the proscribed ingredients, as alcohol, ether, chloroform, opium, morphin, codein, acetanilid, etc.

The quality of the crude drugs imported has materially improved, as is noted also in the report on the New York laboratory where the greater number of imported drugs is received. Official crude drugs, for which the United States Pharmacopœia prescribed definite standards, are less frequently found to be below the specified strength in alkaloidal material, resin content, etc. A number of importations of official drugs for which no specific standard exists, however, were found to be of inferior quality. These included digitalis, senna leaves, uva ursi leaves, buchu leaves, and cubeb berries. Such goods were found to be either improperly cured or contaminated with foreign material, such as sticks, stems, and leaves, indicating that the inferior quality is due to improper or careless collecting and curing rather than to gross adulteration. During the fiscal year henbane leaves offered for entry showed a great improvement, but some consignments were still found below the minimum alkaloidal requirement. The practice previously in vogue of importing *Hyoscyamus muticus*, a spurious henbane, under the name "henbane," has virtually ceased. During the early part of the year many importations of saffron were found to contain an excessive quantity of yellow styles, and it was said to be impossible to procure this product without a large amount of this foreign material. Importations received during the last six months, however, indicate that this statement is not well founded and that there is no difficulty in obtaining these goods reasonably free from the objectionable material. The substitution of calendula florets colored with coal-tar dye for saffron, and the weighting of saffron with inorganic material, which frequently occurred when the law first went into effect, have virtually ceased.

Considerable difficulty has been experienced in regard to the importation of Haarlem oil. After purging the printed matter of the false and misleading claims and representations regarding the medicinal virtues of the article, the question arose as to the composition of genuine Haarlem oil, and the place of manufacture. A mass of information has been accumulated through the aid of the State Department and the trade regarding the status, merits, and composition of the various brands. The questions regarding the true place of manufacture have been very largely answered and the indications are that the whole matter will soon be adjusted satisfactorily.

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During the early part of the fiscal year a number of importations of so-called "synthetic balsam Peru" were offered for entry, invoiced under some such names as "balsam Peru" or "synthetic balsam Peru." Examination showed that they were artificial mixtures, pure and simple. Such goods are intended to be employed instead of natural balsam Peru recognized in the United States Pharmacopœia, Analysis of this product showed that it did not comply with the pharmacopœial standards for the official product, and, from analytical data and other information available, it is evident that the article in question is purely an imitation of the genuine product.

Importations from oriental countries offered for entry under the guise of medicinal preparations were found to contain opium or morphin. These products are put up in various forms, such as small red pills coated with cinnabar, contained in bottles or wrapped in paper and inclosed in paraffin or in wax globules. Others are in the form of tablets. Such goods have been invoiced under various names, as "tonic pills," "stimulant pills," "tea cake," etc. The products are recommended, in the English or in the Chinese language, or both, for those who have been addicted to the opium or morphin habit, and also for coughs, colds, consumption, etc. Such products are obviously used to supply drug addicts and to promote drug enslavement. In some instances the statement is made in the Chinese language that the goods do not contain morphin, and that they are beneficial for "women and children, male and female." Other importations of products have been offered for entry containing habit-forming drugs, as opium, morphin, cocain, codein, chloroform, and ether, recommended for certain children's diseases, coughs, colds, etc.; for example, the products "pastiglie dower," containing opium, and "pastils of codein," containing morphin and codein. These goods are in the form of a confection, sweet and attractively flavored. In the hands of mothers, children, and those who are not familiar with the properties of such constituents, the great danger of their indiscriminate use is apparent.

Interesting facts have developed regarding the importation of certain linseed, licorice, and chlorodyne cough lozenges. This preparation is in the form of a lozenge, is not unpleasant to the taste, and contains, among other ingredients, chloroform and ether. When a consignment was detained it was represented to be sold only as a medicinal agent for coughs, colds, etc.; but an investigation showed conclusively that in certain localities the product was sold indiscriminately and extensively to school children and others as a confection, without any warning whatever regarding its dangerous character. All such products as the above are detained and prohibited entry under section 11 of the law, as being dangerous to the health of the people of the United States.

EXAMINATION OF FOODS AND DRUGS AT THE BRANCH LABORATORIES.

Heretofore the inspection of imported food and drugs has been largely confined to the ports at which inspection laboratories were established. Invoices of all shipments of foods to all ports in the United States were received at the Bureau of Chemistry, and from time to time shipments to nonlaboratory ports were sampled and ex-

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amined, but the number of shipments so inspected was not large. During the last year the inspection at important nonlaboratory ports has been systematized and placed within the jurisdiction of the respective laboratory ports convenient thereto, as shown by the following assignments. This change will undoubtedly greatly increase the efficiency of the inspection in the territory covered.[a]

Boston food-inspection laboratory, United States Appraiser's Stores, Boston, Mass.: Bangor, Me.; Burlington, Vt. (Calais, Me.); Eastport Me.; Fall River, Mass.; New Bedford, Mass.; Newport, R. I.; Newport, Vt.; Portland, Me.; Providence, R. I.; Springfield, Mass.

Buffalo food-inspection laboratory, Federal Building, Buffalo, N. Y.: Cape Vincent, N. Y. (Malone, N. Y.); Niagara Falls, N. Y.; Ogdensburg, N. Y.; Oswego, N. Y.; Plattsburg, N. Y.; Rochester, N. Y. (Rouse Point, N. Y.); Syracuse, N. Y.

Chicago food-inspection laboratory, Manhattan Building, Chicago, Ill.: Dubuque, Iowa; Marquette, Mich.; Milwaukee, Wis.; Peoria, Ill.

Cincinnati food-inspection laboratory, First National Bank Building, Cincinnati, Ohio: Columbus, Ohio; Dayton, Ohio; Indianapolis, Ind.; Louisville, Ky.

Denver food-inspection laboratory, Tabor Opera House Building, Denver, Colo.: Nogales, Ariz.; Salt Lake City, Utah.

Detroit food-inspection laboratory, Telegraph Building, Detroit, Mich.: Grand Haven, Mich.; Grand Rapids, Mich. (Petoskey, Mich.); Port Huron, Mich.; Sandusky, Ohio; Toledo, Ohio.

Galveston food-inspection laboratory, Old Custom-House, Galveston, Tex.: Brownsville, Tex.; Corpus Christi, Tex.; Eagle Pass, Tex.; El Paso, Tex.; Galveston, Tex.; Houston, Tex. (Texas City, Tex.); (Velasco, Tex.).

Kansas City food-inspection laboratory, Government Building, Kansas City, Mo.: St. Joseph, Mo.

Nashville food-inspection laboratory, Custom-House, Nashville, Tenn.: Memphis, Tenn.

New Orleans food-inspection laboratory, Custom-House, New Orleans, La.: Mobile, Ala.

New York food-inspection laboratory, United States Appraiser's Stores, New York, N. Y.: Albany, N. Y.; Bridgeport, Conn.; Hartford, Conn.; Jersey City, N. J.; Newark, N. J.; New Haven, Conn. (Norwalk, Conn.); Perth Amboy, N. J. (Stamford, Conn.).

Omaha food-inspection laboratory, Post-Office Building, Omaha, Nebr.: Council Bluffs, Iowa; Des Moines, Iowa; Lincoln, Nebr.; Sioux City, Iowa.

Philadelphia food-inspection laboratory, United States Appraiser's Stores, Philadelphia, Pa.: (Chester, Pa.); Somers Point, N. J.; Wilmington, Del.

Pittsburg food-inspection laboratory, Park Building, Pittsburg, Pa.: Cleveland, Ohio.; Erie, Pa.

St. Paul food-inspection laboratory, Old Capitol Building, St. Paul, Minn.: Duluth, Minn. (Minneapolis, Minn.); Pembina, N. Dak.

San Francisco food-inspection laboratory, United States Appraiser's Stores, San Francisco, Cal.: Los Angeles, Cal. (Oakland, Cal.); San Diego, Cal.

Savannah food-inspection laboratory, Custom-House, Savannah, Ga.: Atlanta, Ga.; Charleston, S. C.; Jacksonville, Fla.; Key West, Fla. (Miami, Fla.); (Palm Beach, Fla.); (Punta Gorda, Fla.); Tampa, Fla.

Seattle food-inspection laboratory, Arcade Annex Building, Seattle, Wash.: Great Falls, Mont.; Port Townsend, Wash. (Spokane, Wash.); (Tacoma, Wash.).

Washington food-inspection laboratory, Bureau of Chemistry, Washington, D. C.: Baltimore, Md.; Georgetown, D. C.; Newbern, N. C.; Newport News, Va.; Norfolk, Va.; Petersburg, Va.; Richmond, Va.

The following tabulated statement of the activities of the twenty-one branch laboratories is of interest as indicating in a general way the extent of the work done, the accompanying text showing the character of the examinations made, the classes of foods examined, and the nature of the research work done in connection with the execution of the law.

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[a] An amendment to the Treasury decision inaugurating this inspection has been requested to cover specifically the inspection of imported drugs at these nonlaboratory ports.

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In the reports of the various food-inspection laboratories it will appear that a relatively large percentage of the foods and drugs examined were found to be in violation of the food and drugs act. From this no inference can be made regarding the prevalence of adulteration and misbranding. As the work of the Bureau increases the inspectors become more and more experienced in the collection of samples and are more and more conversant with various brands and types of food. The samples taken by them do not represent the average foods and drugs on sale on the markets, but those which the inspectors suspect of adulteration.

Food and drug samples examined in the various branch laboratories during the fiscal year ended June 30, 1910.

Laboratory.	Imported samples.			Hearings conducted.	Interstate samples.		Miscellaneous samples.	Total samples analyzed.
	Legal.	Illegal.	Floor-inspection samples.		Legal.	Illegal.		
Boston	460	295	12,404	674	744	270	140	1,909
Buffalo	76	29	33	159	146	231	41	523
Chicago	173	125	2,572	365	658	686	42	1,684
Cincinnati	19	4	28	239	1,157	228	1	1,409
Denver	11	.....	11	160	395	175	44	625
Detroit	52	4	92	359	151	144	31	382
Galveston	59	22	365	116	192	144	44	461
Honolulu[a]	272	144	677	131	.....	.....	8	424
Kansas City	.....	.....	.....	103	125	127	.....	252
Nashville	.....	.....	.....	157	191	65	.....	256
New Orleans	95	84	2,891	197	148	108	76	511
New York	2,382	1,632	47,821	1,779	124	297	504	4,939
Omaha	.....	.....	3	69	239	110	100	449
Philadelphia	569	183	5,250	293	41	114	48	955
Pittsburg	47	54	227	197	162	216	55	534
Portland	248	106	4,636	137	112	143	46	655
St. Louis	14	6	239	295	365	281	99	765
St. Paul	74	13	233	85	136	55	4	282
San Francisco	237	209	8,100	491	469	375	153	1,443
Savannah	65	40	26	159	105	51	19	280
Seattle	277	137	1,657	113	50	41	168	673
Total	5,130	3,087	87,265	6,278	5,710	3,861	1,623	19,411

[a] Owing to death of its chief, this laboratory was closed during the month of June; report is total for eleven months.

The wide variation in the figures reported from the different branches is due to the different conditions existing, details from one station to another and for court work, the varying amounts of executive and routine work necessitated at different points, etc. In some cases the hearings are conducted almost entirely by correspondence and again those cited appear in person.

BOSTON LABORATORY.

Of the 1,909 samples analyzed at the Boston laboratory over one-third were imported and included a wide variety of products. Approximately 39 per cent of these were classed as illegal. Of the 1,014 interstate samples, 737 were milk samples, a larger part of which were obtained during the milk campaign of November, 1909, undertaken because there had been much complaint concerning the quality of milk shipped to Boston and Springfield, Mass., from outside the State; approximately 13 per cent of these samples were classed as illegal, quite a number being watered milks from New

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Hampshire and Connecticut. The source of all samples showing added water, excessive filth, or an abnormally high bacterial count was inspected and the conditions in general were such as to account for the insanitary samples, while in several instances deplorable conditions were found. In general, the milk supply of Boston was superior to that of any city so far inspected, but the supply of Springfield was inferior. As a result of the warnings, hearings, and prosecutions which have followed this milk investigation it is believed that the milk shipped in interstate commerce in New England has been appreciably improved. A large proportion of the miscellaneous samples examined during the year were analyzed for the purchasing commissary office of the War Department at Boston. Of the 674 hearings held, 401 were on domestic products, approximately 500 being held in person and the remainder by correspondence.

The following original investigations have been given attention during the year as opportunity has offered:

VANILLA EXTRACT.—The study of the effect of various methods of manufacturing vanilla extract from different kinds of vanilla beans has been continued, including detailed analyses of the extracts examined.

FISH.—The work of the laboratory on fish has been extended to include the detection of the deterioration of canned fish due to decomposition before canning. If this has not gone too far, the appearance of the fish may be nearly normal after the container is sterilized. Fish of this character, however, appear to yield upon analysis an appreciable amount of free ammonia, as would be expected from Pennington's results in similar investigations. This is not true of fresh fish. All samples of fish examined that had been canned two or more years also gave appreciable amounts of free ammonia, and an experiment is under way in which fish packed under known conditions is being submitted to periodical examinations.

CONTAMINATION OF FOOD PRODUCTS BY TIN.—On opening canned fish which has been packed for a long period in tin cans in which the fish is unprotected from the tin, it is invariably noticed that the container is more or less discolored and often badly etched. This recently led to an investigation as to the tin content of canned fish imported through the port of Boston and it subsequently developed that a number of such shipments contained from 300 to 1,200 mg of tin per kilogram—amounts which may be injurious to health. As to the quantity of tin in solution, much depends on the quality of the tin plate, the kind or character of goods, and the length of time the latter have been put up. All fish in acid have been found to corrode the tin very badly, even in a short time; this applies particularly to fish in mustard sauce. Fish in tomato and various other sauces, in bouillon, and smoked fish of all kinds—except when packed in oil—have been found to be especially active in attacking the container. Lobsters, clams, and shrimp also attack cans badly if they are unprotected, while, as is generally known, many fruits and vegetables act in the same manner.

CASHEW NUTS.—Cashew nuts (*Anarcardium occidentale*), grown in tropical countries, where they are highly regarded as an article of food, are being brought into this country in constantly increasing

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amounts, particularly from Jamaica and India. During the past season over 45,000 pounds have been imported through Boston alone, but a comparatively small proportion of these nuts are used whole, the larger part being ground and mixed with other higher-priced nuts of more pronounced flavor, such as the almond. A chemical and microscopical study has been made of cashew nuts, from which their addition in appreciable amounts to other nut mixtures or pastes may be detected.

BUFFALO LABORATORY.

Of the 105 import samples examined at the Buffalo laboratory 29 were found to be illegal, and were either relabeled under customs supervision or reshipped from the country. Port inspections were continued throughout the year at Buffalo, Niagara Falls, and Rochester. Of the 377 interstate samples 61 per cent were found to be illegal, the principal classes of foods inspected being grape juice and other unfermented beverages, fruit and saccharine products, flavoring extracts, spices, dairy products, cocoa, and chocolate. One hundred and fifty-nine hearings were held, of which 117 were reported in writing, 19 held orally, and at 15 the persons cited appeared and presented their statement in writing. Eight citations to hearing met with no response.

Investigations undertaken during the year included a completion of work, previously reported, on the composition of canned peas and beans, the results being published in Bureau of Chemistry Circular No. 54. Methods for the determination of sugars and fat in cocoa products and for the determination of added cocoa shells in such products were also studied and an extended investigation made to provide a satisfactory procedure for determining the alkalinity of ash for use in judging of alkali-treated cocoas. Some collaborative work has also been done on flavoring extracts and paprika.

CHICAGO LABORATORY.

Owing to special work relating to bleached flour, the number of samples examined at the Chicago laboratory in the ordinary course of inspection was somewhat less than during the preceding year. Of the 1,344 official samples of domestic foods analyzed 686, or 51 per cent of the total number, were found to be illegal. The percentages of the samples found to be adulterated or misbranded, in the case of the principal classes of foods examined, were as follows: Cereal products, including flour, 62 per cent; coffee and cocoa, 23 per cent; flavoring extracts, 52 per cent; fruit products, 45 per cent; saccharine products, 55 per cent; spices and condiments, 34 per cent. Citations of hearings have been issued in 365 cases, in the majority of which evidence was presented in person by the party cited or his representative.

Inspection of 2,572 shipments of imported foods on the floors of the appraiser's stores led to the taking of 298 samples, of which number 125, representing 42 per cent of the total number of samples examined, were found to be illegal. The classes of products most commonly found adulterated were dairy products, and preserved meat and fish.

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BLEACHED FLOUR.—The most important work of the year has been in connection with the enforcement of the law against bleached flour. This has involved the examination of numerous suspected samples, the investigation of special problems relating to bleaching, and the attendance of two of the chemists at the New Orleans and Kansas City trials.

About 300 samples of wheat from different sections of the country, representing a great number of varieties and grades, were secured through the Bureau of Plant Industry and ground in an experimental mill in the Laboratory of Vegetable Physiology at Washington. The flour thus obtained was examined at the Chicago laboratory with reference to nitrites. In no case was even a trace of nitrites detected.

A comparative study of the effects of bleaching and aging on the physical properties and chemical composition of flour has been carried out with patent and clear flours from 15 mills located in different sections of the country. This investigation may be regarded as preliminary to a more extensive one planned for the ensuing year.

In the course of the flour investigations a method has been developed for the determination of the "gasoline number," which is a measure of the amount of yellow coloring matter present in the flour associated with the oil. This method, at first designed merely for detecting bleaching, is believed to have a wide application for determining the color value of unbleached flour.

VANILLA INVESTIGATIONS.—A method of determining vanillin, coumarin, and the normal lead number in vanilla extracts, developed during the preceding year, was presented at the Denver convention of the Association of Official Agricultural Chemists, and has been used in the examination of 74 vanilla extracts prepared in the laboratory from as many samples of vanilla beans, representing not only the product of different places of production, but also the different lengths and commercial grades of each. Second extracts prepared in each case from the residue of the first extraction have also been analyzed. It is believed that the results thus obtained will be of value in interpreting the analyses of commercial extracts, and enable the analyst to distinguish genuine vanilla extract from imitations.

COURT WORK.—Chemists from this laboratory have been called on to present evidence in court cases both at Chicago and other points. The time spent in consultation with district attorneys and in court, including the bleached-flour cases, has been approximately equivalent to that of one person for the whole year.

CINCINNATI LABORATORY.

The total number of samples analyzed at the Cincinnati laboratory during the past fiscal year is 1,409, including interstate and import work. About one-sixth of the 1,385 interstate samples were adjudged illegal. Of the domestic samples 101 were milks, 145 fruit products, and 126 flavoring extracts. As the figures show, the milk supply in and around the city of Cincinnati during the past year has received special attention. At the time this work was first undertaken, less than two years ago, nearly 60 per cent of the milk samples were adulterated, but when the last milk campaign was conducted, during June, 1910, only from 6 to 7 per cent of the samples examined showed

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adulteration by the chemical analysis. Bacteriological determinations are not included in this statement. Of the 239 hearings reported, about 100 were conducted by correspondence. The chief of the laboratory was detailed during the year to certain large eastern cities to assist in milk campaigns such as had been conducted at Cincinnati.

DENVER LABORATORY.

The percentage of the 570 interstate samples examined that were found to violate the law was about 31, a slight but not significant decrease as compared with last year. The violations by shortage of weight or measure, which last year predominated, showed a decided diminution, and in most instances were due to lack of uniformity in the size of the containers rather than to any fault of the manufacturer. The form of illegality most frequently found consisted of exaggerated and misleading statements on the labels.

Research work has been continued on lemon extracts and oils, comparing various methods for the determination of citral in these substances. In connection with this work the possibility of determining citronellal in lemon oils has also been studied, using both fuchsin sulphurous acid and metaphenelene diaminhydrochlorid.

A simple and reliable method has been elaborated for making quick ether extract determinations on dry powdered substances, such as cocoa, coffee, spices, etc. Its usefulness lies in the amount of time saved, the process of extraction consuming only a few minutes for each sample as compared with twenty hours by the official method, and the results so far obtained by the two methods agree remarkably well. It is not intended that the proposed method should be substituted for the official one, but it offers a simple and rapid means by which the analyst may separate the genuine from the adulterated samples.

Forty-four samples were examined for the Treasury and War departments, consisting of a few samples of drugs for the Customs Service and a considerable number of spices, etc., for the commissary, Department of the Colorado, cooperative work on methods for the examination of sugars and flavoring extracts and on maple products and the detection of capsicum, etc., in ginger ales.

Nearly all of the 160 hearings held by the Denver laboratory during the year were conducted by correspondence. The territory from which samples are commonly purchased and sent to the Denver laboratory for analysis comprises Colorado, Utah, Wyoming, part of Nebraska, western Kansas, New Mexico, Arizona, and Nevada, a very large but rather sparsely populated area. Again, Denver is not in itself an extensive or important producer of foods as compared with eastern cities, but is a comparatively large distributor of foods through a district covering a considerable portion of the States named. These conditions materially affect the character of the hearings, the results being that few manufacturers are cited on samples examined in the Denver laboratory.

DETROIT LABORATORY.

The work of the Detroit laboratory, as in previous years, has consisted principally in examinations of domestic samples. Of the 295 interstate samples about 50 per cent were found to be illegal. Notice-

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able among these were 49 illegal samples of fruit products out of 56 examined, and 46 out of 125 flavoring extracts. The miscellaneous samples analyzed were chiefly those submitted by the Treasury Department and others used in cooperative work with the Bureau. Of the 56 samples of imported food and drug products only 4 were found to be in violation of the food and drugs act. Besides the imported samples taken from the Detroit appraiser's stores, samples were also received from Grand Rapids, Port Huron, and Toledo. Over 50 per cent of the 359 hearings were on flavoring extracts and fruit products, at which approximately 60 per cent of those cited appeared in person.

GALVESTON LABORATORY.

The examination of imported foods constitutes the less important part of the work of the Galveston laboratory. Wines, liquors, tinned fish, oils, and canned vegetables comprise the greater part of the entries at this port, and of the 81 samples examined, about three-fourths were adjudged misbranded or adulterated.

The 336 domestic samples examined were principally canned fruits, flavoring extracts, cocoa, chocolate, spices, condiments, fruit juices, fermented liquors, cereals, and sirups, of which about 43 per cent were adjudged illegal. The territory from which these samples were drawn is principally limited to Texas, with a few from Louisiana, Oklahoma, and adjacent States. Of course, the percentage of samples found illegal is no criterion of the average of food products brought into this territory, since these samples are selected by the inspector as being suspicious. Instances of products dangerous to health were rare, but cases of willful misrepresentation were not uncommon, particularly in the case of extracts artificially compounded to imitate the genuine, about 54 per cent of those examined being found illegal. About half of the fruit juices and 30 per cent of the fruit products were also adjudged illegal.

The hearings held at this laboratory on domestic cases have been largely those accorded to retail dealers and are conducted almost entirely by correspondence, owing to the distance involved.

There being no other government laboratory in this district, a number of miscellaneous examinations were made for the Treasury Department, from time to time, in connection with the customs work.

In addition to the regular inspection of samples, methods of analysis proposed for cocoa, the determination of citral in lemon oil, the determination of preservatives, and of color in whisky have been tested, and analyses of oysters and water from the local oyster reefs have been made in connection with the oyster investigations of the Division of Foods.

KANSAS CITY LABORATORY.

Almost half of the 252 samples examined were found to be illegal, the proportion varying from 90 per cent in the case of fruit juices and nonalcoholic beverages and of fermented beverages to 14 per cent for coffee and cocoa. Cereal, fruit, and saccharine products were the principal articles examined. Of cereal products 77 per cent were illegal, of dairy products 53 per cent, of flavoring extracts 50 per cent,

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of fruit products 41 per cent, of oils and fats 33 per cent, of saccharine products 28 per cent, and of spices and condiments 25 per cent.

For nearly two months the regular activities of the laboratory were diverted to the preparation of the bleached flour case which was tried in Kansas City June 1, and which was decided in favor of the Government.

Some collaborative work on methods was done, chiefly dealing with the determination of citral in lemon extracts. An apparatus was perfected for the convenient and rapid photography of labels, these being necessary to show the "design and device" as well as the wording. The main feature of the apparatus is the use of focusing scales and the elimination of the dark room, the whole operation being so simple as to permit of its being turned over to an unskilled person.

NASHVILLE LABORATORY.

Of the 256 interstate samples examined 21 were check analyses, all reported as illegal, excluding which about 19 per cent of the samples were adjudged either misbranded or adulterated. Flavoring extracts, vinegars, and spices furnished the greater part of these. A vinegar investigation was made in connection with the New York laboratory, during which vinegar plants at Memphis, Tenn., Cairo, Ill., and Paducah, Ky., were visited and a special study made of the samples so obtained.

In connection with this work 157 hearings were conducted, in the majority of cases by correspondence.

NEW ORLEANS LABORATORY.

The work of the New Orleans laboratory has been closely confined to the routine examination of interstate and import samples, owing to the serious illness and absence of the chief.

Some of the 76 unofficial samples were examined for the purchasing commissary of the United States Army, and others for the United States Grain Standardization Laboratory, the remainder being analyzed in connection with the bleached-flour investigation. For about a month the entire resources of the laboratory were devoted to the preparation of the bleached-flour case which was tried in New Orleans February 10, 1910.

Work on a method for the detection of corn oil in mixtures, particularly with cotton-seed oil, was planned, pure samples of corn oil and cotton-seed oil being obtained and known mixtures made.

The inspection of bulk olives offered for entry into the port of New Orleans has shown over 90 per cent of them to be wormy and unfit for food. Nearly 3,000 floor inspections resulted in the examination of 179 import samples, about half of which were adjudged illegal, fruit products, meat and fish, and vegetables furnishing the greater part of these.

The more important classes of domestic products examined were coffees and cocoas, dairy products, fermented liquors, flavoring extracts, and fruit and saccharine products, of which over one-third were found to be illegal, about 42 per cent of all of the domestic samples proving to be either misbranded or adulterated.

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NEW YORK LABORATORY.

INSPECTION WORK.—The New York laboratory is chiefly concerned with the inspection and examination of imported food and drug products, as provided for by section 11 of the food and drugs act. During the past year 47,821 cases of foods and drugs were inspected on the examiners' floors, from which no samples were taken; 4,014 samples were analyzed in the laboratory, of which 1,632, or about 40 per cent, were found to be in violation of the law. One hundred and thirty-five shipments were reshipped or destroyed, and 1,245 shipments were permitted entry after being relabeled or sorted. The principal food products analyzed were fruit and fruit products, cheese, edible oils, liquors, essential oils, cereal products, and spices. Among the food products examined during the past year were a large number of shipments of beans from Italy, which were infested with a small fly, the bite of which produced a rash on the workmen on the docks. A large number of shipments of figs were found to be so badly infested with worms and worm excreta as to necessitate their reshipment.

With regard to the crude drugs presented for entry, a marked improvement in quality is noted, as is shown by the following review:

Belladonna leaves.—These have improved very much in quality. From about 60 shipments examined, less than 10 per cent have been deficient in assay. Of these about one-half contained scopola leaves.

Belladonna root.—About 20 shipments were examined, 3 of which contained poke root, and were decidedly deficient in alkaloid. Some large shipments, however, averaging 50 bales, equaled or exceeded the pharmacopœial requirement as to alkaloid content.

Asafœtida.—This commodity, although there has been a considerable improvement, is still, as a rule, of poor quality. Of 45 shipments examined more than half did not come up to the U. S. P. standards.

Cinchona.—Of the 28 shipments entered all samples taken were above the U. S. P. standard.

Benzoin.—Of 21 shipments entered practically all complied with the 15 per cent insoluble standard. Several, however, were entered for "technical purposes only," and declared 25 per cent insoluble in alcohol.

Jaborandi.—With the exception of one sample, consisting of a false variety, all the jaborandi has been of excellent quality, assaying about 0.75 per cent, which exceeds the U. S. P. requirement.

Copaiba.—Of 105 shipments entered only 2 per cent contained foreign resins. Copaiba has improved to such an extent that the South American importations are practically pure. Five large shipments of African balsam were entered, consisting of about 200,000 pounds.

Balsam Peru.—Sixty-two shipments were entered. The San Salvador and Colombian varieties are up to the U. S. P. standard.

Synthetic Peru.—A very close imitation of the natural has been offered, but the majority is brought in for technical use only. Nine shipments of "perugene" were entered in the same way.

Henbane.—Of over 30 shipments entered, although many assay as high as 0.13 per cent, yet over 20 per cent are deficient in alkaloid, due to the excessive amount of sand mixed with the leaves.

Stramonium.—Thirteen shipments were entered, all of which were of good quality.

Quince seed.—Sixteen shipments were entered, of which over 75 per cent were detained because of excessive foreign material averaging 40 per cent.

Jalap.—Eighty-four shipments were entered, and of 11 samples analyzed but 1 was deficient in resin. The resin content averaged 10 per cent.

Rhubarb, colchicum, chamomile, ipecac, coca, tolu, guarana.—These continue to be of excellent quality. With one exception gentian roots were up to the standard. As before stated, adulteration has decreased to a large extent, resulting in the importation of drugs of superior quality.

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Four hundred and twenty-one interstate samples taken by the inspectors in the regular way were examined at the laboratory during the past year, 297, or 70 per cent, of which were found to be in violation of the law. Of these samples 68 were coffee, of which 55, or 80 per cent, were illegal, a majority being falsely represented to be Mocha and Java mixtures. A marked improvement in the labeling of coffee in this respect has been noted since the inspection of this product was commenced.

One hundred and thirteen samples of vinegar were analyzed, 67 per cent of which were found to be adulterated, the chief form of sophistication being the substitution of mixtures of distilled vinegar and boiled cider for the true cider vinegar.

Aside from the imported and interstate samples analyzed, there have been received from the Panama Railroad Company, the Isthmian Canal Commission (medical supply depot), the War Department, the Navy Department, and the Department of Commerce and Labor about 250 samples of food products and medicines for examination as to purity and conformity with the specifications.

Twenty-four samples of food products were also received for analysis for certification for the export trade, certification being granted in all but 5 instances. The remaining 19 samples covered 56 lots, and 56 certificates were issued.

This laboratory has also passed upon 189 samples of denaturants for olive oil. By the provisions of the present tariff act and the regulations of the Treasury Department, olive oil intended for technical use only may be permitted into this country free of duty if denatured in such a manner as to be unfit for food purposes. The kind of denaturant and its fitness for the purpose intended is passed upon by the Department of Agriculture. Thus far the following denaturants have been permitted: Oil of rosemary, oleoresin of capsicum, oleic acid, wood turpentine, pyridin, creosote, and anilin oil. Application for denaturing is accompanied with the material it is proposed to use, which material is sampled by this laboratory and its suitability for the purpose determined.

Investigations.—An investigation of the subject of cider vinegar was begun, the principal factories of the eastern part of the country being visited and the processes of manufacture studied. Samples of raw materials and of the product at the various stages of manufacture were obtained and analyzed. A representative of the laboratory was stationed for some time in one of the factories to study the chemical changes that occur in the product during the daily operation. The work as far as completed promises to be of much value, and it is expected to continue the investigation during the coming season.

The routine and investigation work on the subject of coal-tar colors for use in food products has been continued during the past year, the entire time of one chemist and a portion of that of two others having been occupied with this work. Sixty samples have been examined, of which about 95 per cent were reported as complying with the Department's requirements for certification. The studies of methods for analysis of colors have been continued, and the following have been devised: (1) A method for estimation of iodin in inorganic compounds with special reference to mixtures containing halo-

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gen derivatives of fluorescein and the inorganic halides; (2) the determination of minute amounts of arsenic in products like coal-tar colors; (3) the separation and identification of mixtures of colors permitted by Food Inspection Decision No. 76.

In connection with the drug work of this laboratory an interesting study has been made of a method for the determination of benzaldehyde, cinnamic aldehyde, and vanillin, based on the fact that these aldehydes form insoluble semicarbazones with semicarbazids. The advantages of this method are: (1) Ease of manipulation; (2) drying at 100° C., where the phenylhydrozone methods necessitate a lower temperature; (3) the resulting semicarbazone is crystalline in character, of a definite melting point, and affords a ready method of identification of the aldehyde under examination; (4) accuracy, the duplicates varying within 0.5 per cent.

Other drug investigations included a study of Haarlem oil and one of copaiba. From examinations of the Haarlem oils generally recognized as genuine, this product appears to be obtained by boiling together a fatty oil, sulphur, and turpentine for a considerable time (sixteen to twenty-four hours). The oil so obtained is viscous, brownish in color, and possesses the characteristic turpentine-sulphur odor. The volatile oil is yellow in color and leaves a residue of not more than 15 per cent insoluble in concentrated sulphuric acid.

Experiments made in this laboratory, in which linseed, olive, and castor oil were boiled with sulphur and turpentine for sixteen hours at the boiling point of turpentine, indicate that the nature of the fatty oil has little influence on the properties of the final product. In all cases the volatile oil was yellow in color, contained sulphur, and resembled that obtained from the imported oils in all particulars. No amber oil, tar oil, aloes, etc., were found in any of the imported oils, the yellow color of the volatile oil being due to the combination of sulphur with the turpentine.

A continuation of the study of copaiba shows that the South American products as a rule are dextro-rotatory. This is due to the resin present, which is dextro-rotatory, and since its specific rotation is about +78° in alcohol, while that of the oil is —7° to —35°, the balsam, due to the percentage of resin, is dextro. In the case of African balsam, the original balsam is lævo, the resin lævo, and the oil dextro. Gurjun balsam follows copaiba in its rotation.

The chemists of the laboratory have also done collaborative work on methods of analysis of paprika, preservatives, flavoring extracts, colors, chocolate and cocoa, coffee, sugar, drugs, and medicines.

OMAHA LABORATORY.

Three hundred and forty-nine interstate inspection samples were examined at the Omaha laboratory, about one-third of which were found to be adulterated or misbranded, and 100 miscellaneous samples were received, coming principally from the Treasury Department (internal revenue) and the War Department (office of purchasing commissary). As the chief of the laboratory was detailed to Chicago for over three months, the output of work was materially reduced. Coffees and cocoas, flavoring extracts, fruit and saccharine products, and spices and condiments constituted the largest classes of products examined. Nearly half of the spices and 10 out of 14 cereal products

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were adjudged illegal. Approximately two-thirds of the 69 hearings held were conducted by correspondence.

Research work on methods of analysis has been conducted along the following lines: Determination of benzoic acid in catsup, separation and identification of capsicum and ginger in ginger ale, determination of sucrose, lactose, and fat in cocoa products, and determination of glycerin in wine. The method for the determination of glycerin in wine, with slight modifications, was applied to the determination of glycerin in vinegar. This study gave satisfactory results and new characteristic ratios which furnish additional means of judging the purity of cider vinegar.

PHILADELPHIA LABORATORY.

The inspection of imported products has constituted the principal work of the laboratory, as in previous years. Of the 752 import samples examined, 24 per cent were either adulterated or misbranded, this percentage being practically the same as in 1909. The principal products examined included drugs, spices, condiments, fruit products, and dairy and cereal products.

The total number of domestic samples examined was considerably less than that reported last year, due partly to the increase in the number of hearings and in court work, and also because the samples examined were of such a character that more time was required in making the analysis. The ratio of illegal (114) to the total number of interstate samples examined (155) gives a wrong impression of the character of the products examined, since a considerable proportion of the illegal samples reported were check analyses on samples found to be adulterated at other laboratories and forwarded for confirmatory examination.

For some time particular attention has been paid to the examination of imported cheese, with the result that almost all the foreign cheese now received is correctly labeled as to whether it is made from partly skimmed milk or not. When this work was first started a very large proportion of the Italian and Greek cheese, also Edam cheese from Holland, was made from milk which had been partially skimmed, the goods not being labeled to indicate their true character. At the present time only an occasional shipment is received not properly labeled, and the importers, after having their attention called to the matter, are very willing to cooperate with the Department. The investigations of the character of black and brown mustard seed used in the manufacture of ground mustard revealed the fact that large quantities of wild mustard, or charlock (the so-called Dakota mustard), are being used in the spice mills instead of mustard seed. To the eye this charlock seed resembles very closely the true black and brown mustard, but when examined with a hand lens the difference is very evident. As a result of this investigation some of the spice millers are now much more careful as to the character of the seed bought. A systematic examination has also been made of imported fish products which are packed with tomato sauce or fish bouillon, the examination showing that the tomato sauce and bouillon in many instances have a serious corrosive action on the tin, and that the contents of the cans as a result contain quantities of tin, which may be injurious to health.

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This investigation is still under way, and it is possible that the serious corrosion in instances may prove to be due to the use of inferior tin, as some importations are received which show no corrosion whatever, the interior of the cans being bright and clean.

Collaborative work has been done on methods of analysis of various products, including maple sirup, cocoa products, vanilla extracts, citral in lemon extracts, detection of foreign oil in paprika, detection of fish oils in vegetable oils, determination of color in spirits, and estimation of benzoic acid in tomato ketchup.

The number of hearings (293) held during the fiscal year was approximately 50 per cent greater than in the previous year. From the evidence offered at the hearings, and other general sources of information, the manufacturers and others involved seemed in most instances to be in hearty sympathy with the authorities in the enforcement of the food and drugs act. Many products which formerly were badly adulterated or misbranded are now found to be in strict compliance with the law.

PITTSBURG LABORATORY.

Of the 101 import samples examined, over half were illegal, the greater part of these being cheeses, which are now correctly labeled in the majority of cases.

Three hundred and seventy-eight interstate samples were examined, of which 216, or considerably over half, were adjudged illegal, including 53 out of 76 flavoring extracts, 56 out of 94 fruit products, 14 out of 24 saccharine products, and 14 out of 23 vinegar samples. The greater part of the 55 miscellaneous samples were examined in connection with cases in preparation for prosecution; a few were analyzed for the Treasury Department. Twenty-two samples of Jamaica ginger were prepared and analyzed to serve as standards in a case for prosecution, and experimental work was done on 8 samples of coffee for the same purpose.

Collaborative work on methods of analysis was done on the following subjects: Detection of capsicum in ginger; determination of sucrose, lactose, and fat in cocoa products; determination of benzoic acid in ketchup; and the analysis of sirup. Two new methods of analysis were devised during the year: One, a rapid method for the determination of fat in cocoa and chocolate products, which greatly shortens the time of analysis; the other, a very rapid method for the detection of lemon and orange peel color in lemon and orange extracts, respectively. An improvement in the method for the detection of caramel in vanilla extracts is now being elaborated. Investigations of imported fish disclosed the fact that amins in these products on distillation will give formaldehyde reactions.

Twenty-two interstate samples were collected by this laboratory. One of these consisted of eggs in a very bad condition and a seizure was made, followed by criminal prosecution, the shippers being fined $200. The dealer followed this by a civil suit and secured $1,800 damages.

A considerable amount of imitation vinegar has been seized, but it is evident that vigorous measures will be necessary to break up this practice. Conditions affecting cleanliness in the preparation of food products have improved considerably during the year, and there

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is a tendency among some manufacturers to put up more of the better grades of goods and less of the cheaper ones.

PORTLAND LABORATORY.

In addition to the import and interstate work, 46 miscellaneous examinations have been made for the War, Treasury, and Post-Office departments and for the state dairy and food commissioner, and in the course of cooperative work in the study of methods for the analysis of extracts, cocoa products, ketchups, ginger ale, etc. Of the 354 import samples, 29 per cent were adjudged illegal, and of 255 interstate samples 56 per cent were illegal.

One hundred and thirty-seven hearings have been called, in which it appeared, especially in regard to import cases, that the misbranding and adulteration were more often due to carelessness and ignorance than to any willful intent to violate the law.

Vinegar factories at Salem and Portland, Oreg., have been visited and samples obtained for information and study, especially of the "second pressings" to determine to what extent it is permissible to use them in the manufacture of cider vinegar.

ST. LOUIS LABORATORY.

Of the 646 interstate samples examined, 43 per cent were considered illegal. The total of 765 samples included 99 unofficial samples, quite a number of flavoring extracts, baking powders, and other goods having been analyzed for the purchasing commissary of the United States Army at this point.

The most important research was done on vinegars, 47 unofficial samples being examined in an effort to obtain information as to the composition of brown-sugar vinegar, molasses vinegar, and corn-sugar vinegar, and to determine as definitely as possible the change taking place in the composition of the material during the process of manufacture. This work, while as yet incomplete, has yielded a great deal of information which will be of valuable assistance in judging vinegars in the future.

Of the 295 hearings recorded, 5 pertained to imported food products, and these being misbranded, in all cases save one, they were released to the importer after relabeling.

ST. PAUL LABORATORY.

Investigations on the bleaching of wheat flour were continued, special regard being given to the grade or quality of the flour treated. As a result it has been possible to produce evidence of misbranding of so-called "patent flour" in a number of instances where seizures have been made. Work on the composition of the known grades of flour is also continued from time to time with a view to the fixing of percentage limits of the several constituents of flour which have bearing upon its grade or quality.

Collaborative work has been done on methods for the analysis of cocoa products, sugar and molasses, ginger products, vinegar, vanilla flavoring, and citral in lemon extract, and on the examination of linseed oil. An investigation was also made of the chemical compo-

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sition of sorghum sirups of known purity, and another to determine the amount of alum in pickles.

A somewhat extensive investigation of edible gelatins is now under way to establish methods for their analysis and examination as to origin, commercial purity, and wholesomeness.

Inspection of imported food and drug products is personally conducted at St. Paul and Minneapolis and extended to Duluth by correspondence. Of the 87 samples analyzed, 13 were found to be illegal. Two lots containing 39 cases of moldy and decomposed shelled walnuts were condemned and destroyed by fire. The remaining products were misbranded only and were permitted entry after being satisfactorily labeled. Miscellaneous examinations were made at the request of the local quartermaster of the War Department and the agents of the Treasury Department at St. Paul, Minneapolis, and Duluth.

The general interstate work has been somewhat irregular, owing to the absence of the chief from the station in attendance at court at St. Louis, Mo., New Orleans, La., and Kansas City, Mo., and assisting in the bleached-flour investigation.

Of the 191 interstate samples examined about 29 per cent were illegal, the greater number being cereal products, of which nearly one-third were either adulterated or misbranded.

SAN FRANCISCO LABORATORY.

The study of oriental drugs, begun last year, has been continued, and progress has been made in collecting data for their classification. A considerable amount of collaborative work has been done on methods of analysis of various food products, and some on methods for the detection of rice which has been polished with limestone. Experiments have also been made on special methods of analysis with a view to expediting inspection work.

Of the 1,443 samples of food and drug products examined, approximately 30 per cent were imported and 70 per cent were interstate samples. The actual number of import samples examined, however, is 54 per cent less than last year, while the domestic products have increased 95 per cent.

Of the import samples examined, 47 per cent were found illegal, while of the domestic products 44 per cent were in violation of the law. The most important classes of imported products are: Distilled liquors, 74 per cent illegal; fermented liquors, 53 per cent illegal; fruit juices, 66 per cent illegal; fruit products, 77 per cent illegal; and oils, 65 per cent illegal. Of the interstate samples, the principal items are: Fruit products, 31 per cent illegal; saccharine products, 63 per cent illegal; flavoring extracts, 56 per cent illegal; spices, 48 per cent illegal; cereal products, 50 per cent illegal; coffee and cocoa, 59 per cent illegal; fermented liquors, 72 per cent illegal; and drugs, 41 per cent illegal. Many of the illegal food cases were based on technical misbranding, only a small number of the total being due to adulteration. In the case of illegal drugs, however, practically all of the samples found to be illegal were adulterated either by substituting one substance for another or by adding some foreign and inert material.

The year has seen a considerable decrease in the number of adulterated and misbranded food products coming from abroad. This is

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evidenced by the smaller number of samples that it was found necessary to analyze and a slight decrease in the percentage of illegal samples which were examined. A slight improvement in the quality of the interstate samples is also to be noted. The activity in the enforcement of the law has been greater, more samples have been examined, and the percentage of illegal samples is exactly the same as last year.

Of the 491 hearings conducted, 281 represent interstate samples, an increase of 75 per cent over last year. It is estimated that at least 600 personal appearances were made by importers and those interested in interstate violations in answer to citation issued from this laboratory during the year.

In the matter of relabeling of foreign products the enforcement of the law has been rigid, and a larger proportion of misbranded and adulterated goods has been exported by order of the customs authorities than ever before. If this rigid enforcement is continued, but little trouble will be experienced with imported foods.

SAVANNAH LABORATORY.

The assistant chemist was assigned to the New York laboratory for about four months, which, together with the increased amount of executive work in connection with the domestic and import samples, contributed to reduce the number of samples examined. Considerable time was devoted to the study of methods for the determination of sodium benzoate in different food products.

Of the 156 interstate samples examined, covering a wide range of foodstuffs, such as flavoring extracts, spices, sirups of various kinds, canned oysters, jellies, jams, preserves, olive oils, etc., 51, or about 33 per cent, were found to be illegal.

Of the 159 hearings, 119 were concerned with interstate samples and 40 with imported products.

SEATTLE LABORATORY.

At this laboratory the examination of imported food and drug products constituted the bulk of the work done, 414 samples being analyzed, of which about one-third were found to be adulterated. The largest classes of imports examined were fish and meat, medicinal preparations, and olive oils. Of the 83 samples of fish and meat examined, 18 were found adulterated or misbranded, 36 of the 62 samples of medicinal preparations, and 14 of the 37 samples of olive oil. Seventy-three samples of miscellaneous imported products have been examined for the customs officials of this district to aid them in their classifications, and 18 samples for the internal-revenue officials of the Treasury Department; other miscellaneous samples were also examined for the Navy Department and the purchasing commissary of the War Department. Of the 91 interstate samples about 45 per cent were found to be adulterated or misbranded, spices and condiments, fruit products, and fermenting liquors furnishing the greater number of illegal samples. About half of the 113 hearings reported were conducted by correspondence.

Special investigations were made along the following lines: A study was made of the salmon-canning industry on Puget Sound with special reference to the factory conditions and to the grade of canned

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salmon known to the trade as "do-overs;" the chief of the dairy laboratory was assisted in the analytical work connected with the investigation of the condensed milk industry of the Northwest; analyses were made of authentic samples of cider vinegar; and cooperative work was done on existing methods for detecting colors and analyzing headache mixtures and flavoring extracts.

MISCELLANEOUS INVESTIGATIONS.

WORK OF THE MISCELLANEOUS DIVISION.

In the Miscellaneous Division, under the direction of J. K. Haywood, chief, are conducted the examinations of waters, insecticides and fungicides, cattle foods and grain, trade wastes, hygienic and miscellaneous samples, and the research work along these lines.

The administrative work and correspondence of this division, especially that relating to the enforcement of the national food and drugs act in so far as it applies to waters, cattle foods and remedies, and grains; the preparation of cases under the food and drugs act on such materials, and travel in connection with expert work in court cases have occupied a large part of the time of the chief of the division. Field work on the effect of smelter fumes on agricultural products, forests, animals, and irrigation streams necessitating the study of methods of eradicating smelter fumes has also formed an important feature of the year's work.

The Miscellaneous Division analyzed approximately 1,629 samples, requiring about 9,060 determinations, in addition to the samples examined during the course of special investigations. Following is a tabulated statement of the materials analyzed, showing the scope and distribution of the work:

Imported mineral and table waters	50
Domestic mineral and table waters	225
Interstate shipments of ice	16
Miscellaneous waters	58
Imported cattle and poultry food and grains	13
Domestic cattle and poultry food and grains	497
Miscellaneous feeds and grains	233
Insecticides and fungicides	214
Trade wastes samples	240
Miscellaneous and hygienic samples	83
Total	1,629

Quite a number of these examinations were made for other departments of the National Government and other bureaus of the Department of Agriculture, as follows:

War Department	3
Department of Commerce and Labor	30
Interior Department	31
Isthmian Canal Commission	9
National Zoological Park	2
United States Senate	1
Department of Agriculture:	
Bureau of Plant Industry	229
Bureau of Entomology	193
Bureau of Forestry	8
Irrigation and Drainage Investigations	3
Unclassified samples examined for various other departments and bureaus	43
Total	552

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The most important of the 83 unclassified samples examined were hops, food dyes, and macaronis analyzed to determine whether or not arsenic was present. The greater part of these miscellaneous samples were examined at the request of other departments or other bureaus of the Department of Agriculture.

EXAMINATION OF WATERS.—The Water Laboratory under the food and drugs act examines samples of mineral and table waters which enter into interstate commerce and also those which are imported into this country. It also analyzes public water supplies for the purpose of detecting pollution and suggesting remedies therefor, examines waters for irrigation and technical purposes and mineral springs of the United States from source, and studies improved methods of water analysis.

During the year 349 samples were examined, and out of the 50 foreign waters 18 were found to be mislabeled. Of the 241 interstate samples of bottled mineral and table waters and ice 37 were found to be illegal. Thirty complete analyses of samples of water from fish-hatchery stations in various sections of the country were made at the request of the Bureau of Fisheries of the Department of Commerce and Labor. Miscellaneous samples examined for other branches of the government service were as follows: War Department, 2; United States Senate, 1; Interior Department, 31; Bureau of Plant Industry, 10; Bureau of Forestry, 8; Drainage Investigations, 3.

The investigation of mineral springs at source has been continued, and data previously obtained collated.

Several other lines of original research previously begun have been continued. The investigation of a method for determining very small amounts of lithium has been completed, and has been of great value in determining lithium in samples of mineral waters collected under the food and drugs act. The investigation of the radioactivity of certain mineral waters has been continued, and the data obtained have been used in examining products claiming radio-active products. A study of sulphur waters and of the several forms of sulphur compounds existing in waters was begun. Some time has also been devoted to the perfecting of methods for the analysis of waters for sanitary, technical, and industrial purposes.

INSECTICIDES AND FUNGICIDES.—The composition and method of manufacture of insecticides and fungicides are studied, as well as the effects that they have on foliage, with the idea of increasing the efficiency of these products and suggesting methods of avoiding injury to vegetation. Investigations to discover new and improved insecticides are being constantly made and improved methods of examining various insecticides are being studied.

The greater number of the 214 samples examined were the products of cooperative work with the Bureau of Entomology and the Bureau of Plant Industry. In addition to the examination of samples submitted for analysis considerable time was given to the investigation of problems connected with the use and application of insecticides. Questions are always arising in their use which require the cooperation of the chemist in their solution. During the past year 8 investigations of this character, requiring more than 300 determinations, were made. One of the most important of these was in collaboration

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with the Bureau of Entomology, to determine the efficiency of sodium cyanid as a substitute for potassium cyanid in fumigating operations; the proper proportion of cyanid, acid, and water to be used to obtain the greatest yield of hydrocyanic-acid gas, and the effect that impurities in the cyanid, principally chlorids, will have on the reaction. This work has been completed, and the results are of no small economic value.

The investigations of lead arsenate, begun in 1907 in cooperation with the same Bureau, have been published as Bulletin 131 of the Bureau of Chemistry. The examination of 50 samples of lead arsenates found upon the market are given, together with directions for preparing homemade lead arsenate, the chemical examination of the materials from which it is prepared, and the observed effects of different lead arsenates and the impurities they may contain on peach foliage. Results of importance were obtained, and the work is being further continued. Orchard tests are being conducted with numerous poisonous materials which have sugegsted themselves as of possible value as insecticides, with the hope of discovering some compound which may be used on peach and other tender foliage without causing injury thereto.

Another investigation, begun last year in cooperation with the entomologist, on the toxic effect on orchards of certain elements, notably copper and arsenic, which may accumulate in the soil as a result of spraying, is still under way. This will require the examination of many orchards before any definite conclusions can be drawn.

On account of the increasing interest in the subject of insecticides, more accurate and detailed methods for their examination are demanded, manufacturers in particular being especially interested at this time in this subject, owing to the recent passage of a national insecticide law in regard to the inspection of insecticides and fungicides. Much time has been devoted to this subject, particularly as concerns methods for the analysis of the comparatively new and important insecticides, lead arsenates. This work and that in connection with the orchard experiments have required during the year approximately 500 determinations which do not appear in the tabulation.

CATTLE FEEDS AND GRAINS.—The total number of samples examined in the laboratory studying these materials was 743, including samples of cattle and poultry food and remedies, both foreign and domestic, examined under the provisions of the food law, as well as samples examined in connection with the study of such economic problems as the feeding value of forage crops, the composition and value of various grains and cereals and of their milling quality, and of improved methods of examining such materials.

Some time was spent in the study of methods for the determination of starch and sugars in cattle foods, requiring approximately 1,000 determinations, a special study being made of the cause of varying results obtained in the starch determinations in cotton-seed meal. An improvement of the apparatus for fat extractions was also devised.

Of the 497 interstate samples of cattle foods and grains examined 125 were found to be illegal. The 233 miscellaneous samples analyzed were received principally from other bureaus of the Department.

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TRADE WASTES IN RELATION TO AGRICULTURE.—These studies of the relation of the disposal of harmful wastes to agricultural operations and to the purity of streams are of great economical importance. Particular attention has in the past been given to a study of the effect of smelter wastes on agricultural products, forests, animals, and irrigation streams.

This work involved the examination of 240 samples during the year, about 600 determinations being made. A study of the effect of copper salts on certain grain crops was necessary to determine the effect of tailings from smelters on farm crops irrigated with water containing same. At the request of the Department of Justice the chief of the Miscellaneous Division visited Ducktown, Tenn., to inspect the improvements made in local conditions by the installation of sulphuric acid plants at the two Ducktown smelters, such acid plants being erected for the purpose of condensing the sulphur dioxid and trioxid fumes from the smelter operations. A study was also made of the process of sulphuric acid manufacture as conducted at these smelters. The results of the two investigations were transmitted to the Department of Justice.

An investigation of the effect of smelter fumes on forests and ranges in the vicinity of Anaconda, Mont., with special reference to the United States Government forest and ranges, was completed during the year, and the results, together with certain previous work on smelter fumes, were published as Bulletin 113, revised, of the Bureau of Chemistry.

INVESTIGATIONS OF THE LEATHER AND PAPER LABORATORY.

The routine work of testing government supplies, notably papers, for the several branches of the federal service has continued to increase; but more especially is this true of the researches concerning leather, paper, and turpentine. The following summary shows the number and kind of samples that have been examined:

Papers and paper-making materials:	
Washington	3,587
Dayton laboratory	2,177
Leather and leather-making materials	117
Turpentine, rosins, oils, and wood products	142
Miscellaneous	71
Total	6,094

Some indication of the usefulness of the laboratory to other branches of the service is afforded by the fact that, of the total number of samples examined, about 5,000 were for other departments.

Paper tests have been regularly made at Washington and at Dayton, Ohio, for the Post-Office Department, and also for the Government Printing Office, General Supply Committee, Bureau of Engraving and Printing, Isthmian Canal Commission, and other branches of the Government. Special investigations have been made of the postal-card paper at the request of the Post-Office Department, and of blueprint papers at the request of the Navy Department. Specifications for papers of maximum durability have been prepared at the request of the Census Office, and assistance has been rendered the American Chemical Society, as well as several of the departments, on

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the same subject. Considerable attention has been devoted to the simplification of the methods for testing paper and to the study of methods. The facilities for the testing work have been so improved since moving into the new chemical laboratories as to render the equipment inferior to none in this country for this class of work.

PAPER AND PAPER-MAKING MATERIALS.—Cooperative studies on rarely used paper-making materials have been made with the office of the crop technologist, Bureau of Plant Industry. The yield and quality of fiber from different varieties of cornstalks, the proper way of cooking and bleaching the fiber, and the most feasible methods of utilizing the extract obtained in cooking the stalk have all been investigated. These experiments are not for the purpose of establishing the fact that paper can be made from cornstalks which has been proved long since, but to devise methods which will place the process on a profitable basis. Several other new raw materials have been examined as to their suitability for paper stock, but with negative results from the practical point of view. The problems involved in the utilization of new materials are, as has been previously pointed out, primarily those of cost of raw materials rather than of the actual making of paper. The work in progress has for its object the reduction of the cost of raw materials through methods for utilizing the enormous amount of waste which now occurs in paper making. The warning sounded in last year's report is repeated—that in the exploitation of materials not now in general use great care should be exercised in order that the losses incident to hastily considered and incompletely developed processes may be avoided.

TURPENTINE AND ROSIN.—Investigations on the production and nature of turpentine, both gum spirits and wood turpentine, have been continued and analytical methods for the differentiation of one from the other and for the detection of adulterants in either have been studied.

Samples of turpentine taken in connection with the administration of the food and drugs act, June 30, 1906, have been examined and a number found to be adulterated or misbranded. Samples of turpentine and rosin were also examined for the several departments. The waste in the production of these products is very large, both in the woods and at the still. These problems have all been studied during the year.

The question of the grading of rosin has for many years been a bone of contention between the consumers, middlemen or factors, and the producers, with the result that the farmer or producer has been the loser partly through unavoidable but also through avoidable errors in the methods of grading now in vogue. This has occurred, although several of the chief rosin-producing States have laws making it obligatory that each barrel of rosin be inspected by a sworn inspector. Under present conditions the producer does not know what grade of rosin he has made until he receives the report of the factor through whom it is sold. To the end that the producer may know the grade of each barrel of rosin he makes, and in this way have a check on the grading of his product on the market, an accurate but simple and inexpensive method for sampling and grading at the still, which it is believed will add thousands of dollars annually to the income of the turpentine farmer, has been devised. Investi-

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gations looking to the improvement of the quality of rosin are being conducted, but are not sufficiently advanced to warrant conclusions.

The quality or grade of rosin is determined by its color and freedom from foreign materials, and is established by comparison with standard type samples. Much dissatisfaction now exists owing to the changes which occur in these types, and the laboratory is investigating the feasibility of preparing permanent rosin type standards with which the types used in the actual grading may be compared from time to time to assure their accuracy.

LEATHER.—The research work on sole leather had for its primary purpose the improvement of the quality of the product and the devising of tests for its examination. In this work the cooperation of several large manufacturers of shoes has been secured, such manufacturers in general being much interested in preventing the adulteration of leather with materials which are useless or harmful. The work so far done indicates that much, if not the larger part, of the sole leather now on the market has been heavily loaded with glucose, Epsom salts, barium sulphate, etc., or with two or more of such materials. This practice from the point of view, both of the consumer and of the manufacturer of shoes, is utterly without excuse, as the quality and wear of the leather are certainly materially reduced thereby, while its cost is increased. In these days, when the quantity of tanning materials and hides available is barely sufficient to meet the demand, every effort should be made to conserve them through the manufacture of leather of the highest quality and greatest durability. The work on leather has progressed sufficiently to justify the conclusion that vigorous steps should be taken to prevent the adulteration or loading of leather in any way.

MISCELLANEOUS WORK.—Miscellaneous samples, including fertilizers, wastes, oils, and various industrial materials, have been examined at the request of other departments and of other bureaus of this Department, and the laboratory has cooperated with chemical associations in the study of methods for the examination of leather and tanning materials, in the preparation of specifications for suitable and permanent paper for scientific publications, and in the study of methods for the estimation of iron and alumina in phosphate rock. The work of the Leather and Paper Laboratory is in charge of F. P. Veitch.

EXAMINATION OF CONTRACT SUPPLIES.

The constant demand for the testing of current supplies by the various governmental branches, accompanied generally by the request that the work be rushed as rapidly as possible, leaves little or no time for systematic research. Considerable work has been done in the revision of existing specifications for miscellaneous supplies and the preparation of definite specifications where formerly none was used. A large number was prepared for the General Supply Committee and for the Commissioners of the District of Columbia, with the result that the number of samples tested was diminished very much as compared with preceding years by letting the contracts on the bases thus established and thus rendering sampling on competitive bids unnecessary in many cases. Some progress has been made also

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on the study of the composition of rubber goods, with a view to drawing up specifications for this class of material, and an investigation of paint materials has been begun, including the preparation for some extensive paint tests.

As to the bulk of the work accomplished, the number of samples examined for the various government departments showed a very great increase over that of the preceding years, being the greatest ever examined in any one year since the establishment of the laboratory. The attached table shows the distribution of this work, according to the character of the material examined and the department for which the examinations were made. The character of the samples varies greatly, but the larger number was under the classes of colors, paints, and varnishes, and oils, fats, greases, and waxes. The greatest increase in any one class of samples examined was in typewriter ribbons, of which 595 were tested as compared with 73 in the previous year. The total number of samples examined during this year is 2,829, which does not include more than 3,600 pieces of apparatus tested for the Bureau of Chemistry. This work is done under the supervision of P. H. Walker.

Number of samples of contract supplies analyzed.

Departments requesting analysis.	Colors, paints, and varnishes.	Oils, fats, greases, and waxes.	Soaps and candles.	Inks.	Typewriter ribbons.	Rubber.	Glue.	Chemicals.	Metals and alloys.	Miscellaneous.	Total.
General Supply Committee	440	194	249	24	569	....	33	....	....	27	1 536
Isthmian Canal Commission	125	177	19	....	....	49	....	28	6	98	502
Treasury Department [a]	258	122	1	....	2	....	30	8	....	19	440
Department of Agriculture [b]	45	31	4	....	13	30	....	....	12	10	145
Post-Office Department	8	....	....	....	46	....	....	....	....	....	54
War Department	10	15	....	....	....	....	....	....	....	3	28
Commissioners, District of Columbia	....	7	12	....	....	2	....	....	....	1	22
Government Printing Office	1	13	7	....	....	....	....	1	....	....	22
Department of Commerce and Labor	3	....	....	....	....	11	....	....	....	....	14
Navy Department	7	....	....	....	....	3	....	1	....	3	14
Interior Department	3	3	2	....	....	....	....	....	....	1	9
National Zoological Park, Smithsonian Institution	3	3	....	....	....	....	....	....	....	....	6
Samples referred to other laboratories	....	....	....	....	....	....	....	....	....	37	37
Total	903	565	294	70	595	82	65	38	18	199	2,829

[a] Including Bureau of Engraving and Printing. [b] Including Bureau of Chemistry.

NITROGEN DETERMINATIONS.

A section in charge of T. C. Trescot is devoted entirely to nitrogen work, which is especially important in the administration of the food law, since the value and quality of a product frequently depend largely on the nitrogen content, as in the case of dairy products and cattle foods. Another important application of these data occurs in the research work on cereals and the examination of the excreta of animals, referred by the Pharmacological Laboratory of the Drug Division in the course of experiments on metabolism. In all 10,500 such determinations were made on samples referred from the various laboratories of this Bureau and from the Bureau of Plant Industry.

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During the past year this laboratory has collaborated with other nitrogen chemists in work looking to the improvement of the present methods, especially those relating to the determination of nitrates in fertilizers. An investigation has also been begun of methods for estimating free and combined ammoniacal nitrogen in foods, a difficult point which has given rise to considerable controversy.

PUBLICATIONS.

During the past fiscal year the following publications have been prepared: Fourteen bulletins, of which 9 are in print; 22 circulars, of which 20 have been issued; 7 unnumbered publications, including the Report of the Chemist and instructions to inspectors and to commissioned state officials concerning the execution of the food law; 8 farmers' bulletins; 16 food-inspection decisions; and 424 notices of judgment; aggregating about 2,580 pages of original matter. Of this, approximately 830 pages were notices of judgment received from the Office of the Solicitor. The food inspection decisions included Nos. 109 to 124 and covered rulings on wines, cordials, whisky, shellfish, rices, stock feed, cocoa, and certified colors. The bulletins covered a wide range of subjects; of special interest are the report on the manufacture of denatured alcohol, the results of experiments on the effect of environment on wheat and on sweet corn, an extensive investigation of the manufacture and composition of maple sirup, with inspection and analytical data, and the farmers' bulletin on preparations containing habit-forming agents, which was widely read and commented upon. More use was made of the circular form of publication this year, both for monographs on details of technical research, such as the enzym studies, and for practical applications of scientific data to commercial conditions, such as work on the cold storage of cider, the utilization of peaches as vinegar stock, and the preparation of sugared pineapples.

Even under the strict rulings governing the distribution of free publications it was necessary to reprint 7 bulletins, 4 circulars, 15 food-inspection decisions, 4 notices of judgment, 5 Yearbook articles, 5 separates, and 2 unnumbered circulars.

There were issued 346 requests for job printing, covering all stationery supplies, forms, circular letters, etc., and 241 requests on the photographic laboratory for drawings and photographs in connection with the illustration of bulletins or the construction of laboratory equipment.

GENERAL BUSINESS OPERATIONS.

There was appropriated for the Bureau of Chemistry for the fiscal year ending June 30, 1910, a total of $930,560. Of this amount $75,560 was for statutory salaries; $112,540 for investigations relating to the application of chemistry to agriculture and for collaboration with other departments; $5,000 for investigating the character of the chemical and physical tests which are applied to American food products in foreign countries and for inspecting the same before shipment; $737,460 for the enforcement of the food and drugs act.

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On June 30, 1910, there were 467 employees in the Bureau of Chemistry, of which number 228 were analysts, 89 clerks, and 41 inspectors. Half of the total number are employed outside of Washington.

During the year 120,000 letters were written to approximately 25,850 correspondents. In addition, 17,500 copies of mimeograph letters, covering 250 subjects, besides a large number of printed circular letters, were sent out, 3,024 requisitions for supplies were prepared, 7,500 vouchers checked and passed for payment, and 896 letters of authorization drawn up; 6,056 guaranties under the food and drugs act were received, examined, filed, and serial numbers assigned thereto. Complete purchase, property, and financial records were kept. Verbatim reports of all hearings before the Board of Food and Drug Inspection are made and complete records, involving a vast mass of detail, are kept, covering the collection and analysis of samples under the food and drugs act, as well as all data relating to each case thereunder.

WORK PLANNED FOR THE FISCAL YEAR 1910-11.

INSPECTION WORK.

The principal work of the inspectors for the fiscal year of 1911 will be, as usual, the collection of official samples of foods and drugs to be used as the basis for criminal prosecutions. This work involves the preparation of testimony to establish sale and interstate delivery, necessitating that the inspectors procure the affidavits requested by district attorneys from dealers and other persons concerned in the prosecution. The regular inspection of factories, for the purpose of observing the character of raw materials used and the sanitary conditions surrounding the manufacture of food and drug products, will be continued.

Attention will be given to interstate shipments of flour bleached with nitrogen peroxid, and instead of confining this work to a special investigation, as heretofore, involving the activities of a limited number of inspectors, it will be made general and include an examination of shipments received in every section of the country in interstate delivery. The investigation of the sardine industry on the northern Atlantic coast will be pursued until the inspector in charge is prepared to recommend what steps should be taken to suppress traffic in sardines shown to be adulterated by reason of the unsanitary character of the fish due to the methods of packing or the surrounding conditions. The milk supply of several cities, which, because of their situation, receive a large portion of milk from adjoining States, will be investigated. It is contemplated to make work of this character more general, necessitating the attention periodically of only a few inspectors at the principal cities, instead of undertaking the investigation by a short campaign, demanding the services of a number of chemists and inspectors simultaneously.

The inspection force will, for the most part, be wholly occupied with the routine work connected with the collection of samples and the prosecution of violations and the investigations made in conjunction with or at the request of the laboratories.

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GENERAL FOOD INVESTIGATIONS.

The work of the Division of Foods and the branch food inspection laboratories will consist largely, as in the past, of the inspection of foods imported into the United States and those sold in interstate commerce. For the purpose of increasing the efficiency of this work and promoting uniformity in the results obtained the collaborative study of analytical methods must be continued and new methods devised from time to time as conditions of manufacture and the character of adulterations change. Investigations regarding the methods of manufacture and the sanitation of foods will be made for the purpose in some cases of improving the methods of manufacture or of assisting the manufacturer to overcome difficulties by reason of which his products are in violation of the law, and on the other hand for the purpose of securing information that will enable the Department to determine whether or not certain products should be considered as illegal.

Among such studies which should be continued or inaugurated during the coming year may be mentioned the changes in composition that occur in the conversion of cider into vinegar; a study of the prevalence in foods of certain added injurious substances, such as arsenic; the solubility of lead solder in foods, especially in foods containing oil of various degrees of acidity; the manufacture of citrus by-products from waste fruits; the chemical composition of the soy bean with special reference to methods for the manufacture and clarification of the oil; clarification and preservation of fruit juices, giving attention to additional varieties of fruit and continuing the investigation of storing at low temperatures under commercial conditions; the effect of low temperatures on the life process of fruits; the composition of several varieties of oranges at different stages of their maturity with a view to securing data that may be used in the definition of types of oranges; a study of canned goods with a view to determining the relative suitability of different grades of tin and the action on tin plate of different varieties of food; a study of the organic acids in various types of foods for the purpose of improving methods of analysis and increasing the data on which judgment of the purity and soundness of foods may be based.

The extensive investigations under way in the Washington, New York, and Seattle inspection laboratories in collaboration with experts concerning the whole question of food colors, their identification, and the construction of analytical trees for this purpose, will be continued. Among the more important researches in progress at the branch laboratories the following should be noted: Vinegar investigations and researches as to the chemical composition of the various products and the same product at different stages of development; study of domestic and imported rices, especially of the Japanese types; work on apple butters to determine the nature of material used; studies on cocoa products, including additional determinations and constituents of the cocoa bean; the effects of aging on the composition, physical characters, and bread-making properties of flour; the amounts of phosphoric acid in jams and jellies of known origin and the detection of added phosphoric acid; the composition of vanilla extracts prepared by different methods, and the detection of caramel therein.

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FOOD RESEARCH LABORATORY.

The plans for the coming year extend and develop the lines of work already begun on the deterioration of poultry. The study of the handling of eggs along similar lines will be especially developed during the next fiscal year, since the question is one of great importance to the consumer and is a matter just now much in the public mind. These studies are of fundamental importance in settling questions raised under the food law. The poultry study, as planned, includes shipping and marketing experiments on fowls chilled in dry, cool air and also in water. The question of "wet" and "dry" packing is one concerning which the shippers do not agree, and it is expected that valuable information for the solution of this problem will be obtained. The study involves, also, some broad problems on the strictly scientific side, since it necessitates work on the relation of humidity, osmosis, temperature, etc., to bacterial growth and chemical change, both bacterial and enzymic.

DRUG WORK.

The Drug Inspection Laboratory will continue to examine domestic drugs, check analyses of imported drugs not provided for by the special laboratories, and keep such systematic records of domestic and imported drugs required for the handling of cases as are necessary. Special investigation of certain drug products imported into the United States which may be dangerous to the health of the people will be made, such as preparations, sold indiscriminately, containing habit-forming drugs. Particular attention will be devoted to the improvement of methods of analysis, such as the detection and determination quantitatively of various alkaloids and other plant constituents contained in the complex mixtures upon the market. The time spent by analysts as witnesses in connection with cases under the food and drugs act will doubtless be increased. Plans have been made, now that some of the necessary preliminary work has been done in the drug field, to have a more vigorous part taken in the drug inspection work by the port laboratories than has hitherto been possible, which will greatly increase the efficiency and thoroughness of the control of such products. Especially is this true of the eastern drugs imported on the Pacific coast.

The pharmacological studies reported as under way will be continued, these being of a nature to require observation for an extended period before final conclusions can be drawn; other studies will be made as necessitated by the questions raised in the prosecution of the drug work.

The work on essential oils and synthetic products will continue along the line indicated in the report; a special study of methods for estimating salicylates will be begun. At the New York laboratory the study of crude drugs will be continued as a special feature of the work, particularly with reference to limits of ash, alkaloids, resin, and volatile and nonvolatile ether extracts.

MISCELLANEOUS DIVISION.

The mineral-water survey of the United States begun in 1904 will be continued. Other important lines of water work under the food and drugs act will be continued. Improved methods of mineral-

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water analysis will be studied and special attention devoted to the determination of the radio-activity of mineral waters, including an investigation of this important subject at the source of certain springs. Sulphur waters will be studied and improved methods devised for the determination of the several sulphur compounds present.

A study of the composition of cattle and poultry foods and remedies which enter interstate commerce, of range forage crops (the latter in cooperation with the Bureau of Plant Industry), and investigations regarding the feeding value, commercial importance, and adaptability of grains and other feeding stuffs will be made. Improved methods of determining the various constituents in cattle foods will be studied with special reference to the fat determination, which, as now made, extracts materials other than fat from certain feeding stuffs.

In addition to the examination of such insecticides and fungicides as may be called for by other bureaus of the Department and the continuation of the study of methods of analysis, the following investigations will be prosecuted: (1) The study of the cause of injury to foliage of fruit trees by lead arsenate and methods for preventing this injury. (2) The supposed injury to fruit trees from the accumulation of toxic salts in the soils, due to the use of insecticides, in cooperation with the Bureau of Entomology. (3) Orchard and laboratory tests of poisonous compounds not at present used as insecticides with the view to finding some substance which may be so used on peach and other tender foliage. (4) The arsenic content of fruits to which arsenicals have been applied in spraying operations.

The effect of toxic gases on different species of plants and the resistance of plants to copper and arsenic in the soil will be studied and field work done to determine the effects of smelter wastes in general on vegetable and animal life.

Studies of the amount of arsenic or other poisonous substances in household articles in general use and other sanitary studies.

SUGAR LABORATORY.

The completion of the extensive investigation under way in regard to the maple-sugar industry and the examination of commercial glucose will be made the most important work of the year 1911, together with the completion of the work on imported honey. The institution of investigations of equal thoroughness relating to cane sirup, sorghum sirup, etc., will follow the completion of the work in hand. The environment studies on the sugar content of watermelons and muskmelons will be steadily advanced.

DAIRY LABORATORY.

In addition to the regular routine work the following special studies will be made: (1) A completion of the study of the process of condensing milk to determine the practical limit of condensation consistent with good mechanical condition. (2) Continuation of the work on the perfecting of analytical methods and checking of analyses received from the branch laboratories. (3) Study of all the brands of malted milk in the United States.

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LEATHER AND PAPER LABORATORY.

The following lines of work will define the researches proposed for the coming year:

(1) The study of unusual paper-making materials and of methods for the utilization of waste from paper making with a view to increasing the availability of raw materials for this purpose.

(2) Investigations of the service qualities and suitability of leather for various purposes and experiments to improve its character with a view to conserving raw material. Also the study of native tanning materials, with particular attention to their conservation.

(3) Studies on the production, refining, nature, and uses of wood turpentine and products of wood distillation. Investigations looking to the improvement of the quality of rosin and methods of grading the same by the establishment of types. The testing of leather, turpentine, and rosin, and the preparation and improvement of specifications for these materials for other departments of the Government upon their request.

CONTRACTS LABORATORY.

The examination of routine samples from the various departments will constitute the greater part of the work. The study of paint and paint materials will be given as much attention as possible and work on the testing of rubber, the revision of existing specifications, and the preparation of specifications for materials for which there are no satisfactory specifications obtainable will be continued. It is proposed also to investigate enamel ware used for cooking utensils, in order to ascertain the relative durability of the different makes and the presence or absence of poisonous metals in the enamel coat; also the relative solubility of such poisonous metals in water and in the dilute acid and salt solutions which would be used in cooking.

MICROCHEMICAL LABORATORY.

The work for the coming year will be largely routine and cooperative as in the past, but in addition to this the following investigations will be elaborated: (1) Condition of eggs and egg products, in connection with which field work is contemplated. (2) The work on ketchups will also be supplemented by commercial investigations, especially with a view to obtaining more exact knowledge as to certain forms of spoilage which occur in this product. (3) The studies on alkaloids will be continued along much the same lines as in the previous two years, studying new forms as they may be obtained, and further studies will be made of the histological structure of drug plants for the purpose of identifying the ingredients in medicinal mixtures. The study of mustards will be completed and the information obtained applied in connection with the examination of this product under the food and drugs act.

SPECIAL INVESTIGATIONS.

ENOLOGICAL CHEMISTRY.

(1) The chemical examination of the grape and apple crops in the northeastern and central fruit sections of the United States.

(2) The preparation of samples of native wines and ciders from the fruit in these districts as supplemental to those already in hand.

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(3) A study of the pomace and other wastes from the grapes and the apples as found at the manufactories.

(4) The collection and examination of native wines, ciders, and vinegars.

(5) The study of pure races of yeasts, with especial reference to their efficiency in producing chemical changes in pure juices at different temperatures and also in the presence of various preservatives.

(6) The further study of technical questions on the cellar practices with fermented fruit products and the economic handling and storing of the same.

PLANT AND ANIMAL PHYSIOLOGICAL CHEMISTRY.

Special emphasis will be given to plant studies during the early periods of growth, and milling and baking experiments to show the influence of environment on the composition of flour obtained from wheat grown under varying conditions. An exhaustive examination of the infants' and invalids' foods now on the market has been begun, and a study of the care, preparation, and modification of foods for infant feeding will be made.

BACTERIOLOGICAL STUDIES.

Special bacteriological work will be done in connection with the sustained investigations of oysters, eggs (including stored, frozen, and desiccated products), milk, ice cream, waters, and ketchups.

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REPORT OF THE CHIEF OF THE BUREAU OF SOILS.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., November 26, 1910.

SIR: I have the honor to transmit herewith a report covering the operations of the Bureau of Soils for the fiscal year ended June 30, 1910.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

PROGRESS OF THE SOIL SURVEY.

THE YEAR'S WORK.

Work was continued during the year in both detailed and reconnoissance surveys, and areas completed or begun in 26 different States, comprising 59 areas.

Cooperation was continued with state authorities, and soil surveys were assigned in cooperating States after consultation with those interested and distributed, as far as possible, to meet the urgent agricultural needs of the State as expressed by those authorities.

During the fiscal year a total area of 22,762 square miles was covered by detailed soil surveys and 79,108 square miles by reconnoissance surveys.

The detailed surveys are conducted on the scale of 1 inch equals 1 mile, and the total area covered to July 1, 1910, is 204,276 square miles, or 130,736,640 acres.

The results of the reconnoissance surveys are shown on small-scale maps, and represent the more important facts relating to the soils, their character, distribution, surface features, etc., while other information necessary for the guidance of settlers in the location of new homes is included in the accompanying reports. The area reconnoissanced to July 1, 1910, was 155,288 square miles, or 99,384,320 acres.

In the sparsely settled regions, or regions of rather uniform soil conditions, the reconnoissance work will supply the information needed for many years to come, or until the country becomes more thickly settled and more intensive agriculture becomes necessary. Combining the area covered by the two classes of survey, it is seen that to July 1, 1910, there had been surveyed and mapped in the United States 359,564 square miles, or 230,120,960 acres.

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The tables following give details of distribution and cost of the work:

Individual areas surveyed and mapped during the fiscal year ended June 30, 1910.

DETAILED.

State or Territory.	Area.	Area surveyed.	
		Square miles.	Acres.
Alabama	Baldwin County	a 465	297,600
	Chambers County	570	364,800
	Clarke County	670	428,800
	Coffee County	a 418	267,520
	Dale County	561	359,040
	Hale County	a 78	49,920
	Jackson County	275	176,000
	Mobile County	306	195,840
	Pike County	346	221,440
	Tallapoosa County	a 185	118,400
	Tuscaloosa County	350	224,000
California	Livermore area	225	144,000
	Madera area	860	550,400
Florida	Jacksonville area	250	160,000
Georgia	Bulloch County	980	627,200
	Franklin County	270	172,800
	Sumter County	534	341,760
Kentucky	Rockcastle County	161	103,040
Louisiana	Concordia Parish	707	452,480
Maine	Orono area	414	264,960
Maryland	Anne Arundel County	a 276	176,640
Minnesota	Rice County	516	330,240
Mississippi	Adams County	460	294,400
	Noxubee County	696	445,440
Missouri	Atchison County	534	341,760
	Cedar County	496	317,440
	Cooper County	500	320,000
	Jackson County	175	112,000
	Marion County	105	67,200
Nevada	Fallon area	235	150,400
New Hampshire	Nashua area	488	312,320
New Jersey	Sussex County	267	170,880
	Vineland area	73	46,720
New York	Ontario County	572	366,080
	Washington County	a 538	344,320
North Carolina	Gaston County	359	229,760
	Granville County	200	128,000
	Mecklenburg County	345	220,800
	Scotland County	a 221	141,440
Ohio	Auglaize County	397	254,080
Oregon	Marshfield area	500	320,000
Pennsylvania	Berks County	a 796	509,440
	Bradford County	112	71,680
South Carolina	Clarendon County	710	454,400
Texas	Ellis County	1,066	682,240
Virginia	Campbell County	550	352,000
West Virginia	Spencer area	a 805	515,200
Wisconsin	Bayfield area	331	211,840
	Iowa County	763	488,320
	Waukesha County	408	261,120
	Waushara County	643	411,520
	Total	22,762	14,567,680

RECONNOISSANCE.

Pennsylvania	South-central area	610	390,400
	Southwestern area	a 5,895	3,772,800
South Dakota	Western area	41,400	26,496,000
Texas	Gulf coast area	10,482	6,708,480
	Panhandle area	a 14,652	9,377,280
Washington	Eastern Puget Sound	3,568	2,283,520
	Western Puget Sound	1,105	707,200
Wisconsin	Marinette County	1,396	893,440
	Total	79,108	50,629,120

a These figures do not include portions of these areas surveyed in preceding years.

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Total areas surveyed and mapped in the several States during the fiscal year ended June 30, 1910, and the areas previously reported.

DETAILED.

State or Territory.	Work during 1910.	Work previously reported.	Total	
	Sq. miles.	*Sq. miles.*	*Sq. miles.*	*Acres.*
Alabama	4,224	18,368	22,592	14,458,880
Arizona	.....	611	611	391,040
Arkansas	.....	2,677	2,677	1,713,280
California	1,085	10,171	11,256	7,203,840
Colorado	.....	2,428	2,428	1,553,920
Connecticut	.....	518	518	331,520
Delaware	.....	314	314	200,960
Florida	250	3,473	3,723	2,382,720
Georgia	1,784	4,366	6,150	3,936,000
Idaho	.....	1,281	1,281	819,840
Illinois	.....	5,925	5,925	3,792,000
Indiana	.....	4,204	4,204	2,690,560
Iowa	.....	2,303	2,303	1,473,920
Kansas	.....	3,175	3,175	2,032,000
Kentucky	161	2,049	2,210	1,414,400
Louisiana	707	7,466	8,173	5,230,720
Maine	414	525	939	600,960
Maryland	276	3,784	4,060	2,598,400
Massachusetts	.....	796	796	509,440
Michigan	.....	4,360	4,360	2,790,400
Minnesota	516	2,197	2,713	1,736,320
Mississippi	1,156	7,786	8,942	5,722,880
Missouri	1,810	5,959	7,769	4,972,160
Montana	.....	432	432	276,480
Nebraska	.....	3,116	3,116	1,994,240
Nevada	235	.....	235	150,400
New Hampshire	488	923	1,411	903,040
New Jersey	340	1,303	1,643	1,051,520
New Mexico	.....	129	129	82,560
New York	1,110	6,937	8,047	5,150,080
North Carolina	1,125	10,607	11,732	7,508,480
North Dakota	.....	6,031	6,031	3,859,840
Ohio	397	4,183	4,580	2,931,200
Oklahoma	.....	1,160	1,160	742,400
Oregon	500	695	1,195	764,800
Pennsylvania	908	4,978	5,886	3,767,040
Porto Rico	.....	330	330	211,200
Rhode Island	.....	1,085	1,085	694,400
South Carolina	710	8,000	8,710	5,574,400
South Dakota	.....	675	675	432,000
Tennessee	.....	6,137	6,137	3,927,680
Texas	1,066	15,105	16,171	10,349,440
Utah	.....	1,501	1,501	960,640
Vermont	.....	227	227	145,280
Virginia	550	5,887	6,437	4,119,680
Washington	.....	1,652	1,652	1,057,280
West Virginia	805	2,839	3,644	2,332,160
Wisconsin	2,145	2,537	4,682	2,996,480
Wyoming	.....	309	309	197,760
Total	22,762	181,514	204,276	130,736,640

RECONNOISSANCE.

North Dakota	.....	39,240	39,240	25,113,600
Pennsylvania	6,505	10,128	16,633	10,645,120
South Dakota	41,400	.....	41,400	26,496,000
Texas	25,134	26,812	51,946	33,245,440
Washington	4,673	.....	4,673	2,990,720
Wisconsin	1,396	.....	1,396	893,440
Total	79,108	76,180	155,288	99,384,320

COOPERATION.

During the year this Bureau has cooperated, as far as possible, with state institutions, including experiment stations, boards of agriculture, and geological surveys; also with Bureaus and Divisions

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of this Department, as well as with other departments of the Government. Such cooperation has been particularly close with state organizations in the States of New York, New Jersey, Pennsylvania, West Virginia, North Carolina, Alabama, Mississippi, Missouri, Wisconsin, and Washington.

All these States with which we are now cooperating are planning to continue the work, and most of them are desirous of increasing the rate at which the work is being done.

These States make special appropriations for soil-survey work. The funds are administered by some of the previously existing state organizations, either the agricultural experiment stations, state boards of agriculture, or state geological surveys. The cooperative agreements between these organizations and the Bureau provide for an approximately equal sharing of the expense of the work by each institution. The Bureau in each case controls the work so far as the methods of procedure are concerned. The determination of the relations of the various soils are made by the Bureau men also. In those States where there are local men who are thoroughly familiar with the local geological and agricultural conditions the details of soil differentiation are left, to a considerable extent, to them. The Bureau by this arrangement profits by the intimate local knowledge of the state officials, and the latter, on the other hand, profit by the broad knowledge of the Bureau staff. The work done is just as much the Bureau's work as is that done in any of the noncooperating States, because it is done according to the Bureau's methods. It is equally the work of the state organizations, since it incorporates the results of their special local knowledge. At the same time the States avoid the expense of developing a plan of work and training a corps of field men of their own. Each party to the agreement profits by the special knowledge of the other and in so doing sacrifices nothing whatever.

The detailed survey work of the Bureau is gradually becoming more and more accurate. This increases the cost somewhat above that of the earlier more generalized work. As a rule, the work carried out under cooperative agreements is the most detailed work that is done. The cost is therefore a little higher per square mile than is that of the work done in the noncooperating States. The cost to the Bureau, however, is less than the latter work, since it pays only about half the expense. It accomplishes a higher grade of work at a less cost per square mile than it is able to accomplish in the other States.

The increased demands for cooperative work should be met by appropriations made especially for this purpose, in addition to the usual appropriations for pushing the work in those States that are not yet ready to appropriate money for carrying on their part of any cooperative agreements with the Bureau.

The soil mapping in a number of States has already extended over more than half their area. It is thought to be especially desirable that the work in some, at least, of these States should be pushed to completion as rapidly as possible in order that such States and such work may be utilized for the planning and execution of experimental work on a comprehensive scale. It seems especially desirable to have a soil map of a whole State completed in order to test more thoroughly than has been possible on the isolated areas mapped so far

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the value of soil maps in the planning of comprehensive study of agricultural conditions.

During the past year many inquiries have been received from experiment-station officers in States not now cooperating with the Bureau concerning possible cooperation with them, and it seems probable that within a very few years every State in the Union will be cooperating with the Bureau in soil work or will be desirous of doing so.

Many of the agricultural experiment stations are conducting various kinds of experiments on crop adaptations, variety tests, fertilizer tests, rotation experiments, and various kinds of agricultural surveys, while others are planning such work. By all these organizations the Bureau is sought for advice about the soil, and soil surveys are sought. The soil survey and mapping of the soils is regarded as the preliminary and fundamental exploratory and research work that furnishes the necessary foundation for all experimental work on the relation of soils to crops. The Soil Survey is coming more and more to be regarded as an institution for fundamental soil study in the field as a preliminary to all experimental work. Its work is not final, and the fact is now well recognized that it can not and does not pretend to solve all the problems of agriculture.

It is, however, a well-established and recognized fact that soil surveys are more or less consciously agricultural surveys. The student of the soil in the field (the soil surveyor) is ever on the watch for soil differences and seeks to recognize all the many facts indicating such differences, whatever they may be. He becomes a student of crops, therefore, as indicators of soil character. He is not an experimentalist. He studies the natural adaptabilities of the soil as expressed in the natural vegetation and in the varied success gained by man under the many methods adopted by the farmers in any one region. The natural vegetation has adjusted itself to soil conditions. Man in most cases in America has not done so, but is unconsciously endeavoring to do so. The complete adjustment has not and probably never will be reached by any one individual, but it may be reached in one particular by one and in another by another individual. It will be well within the province of the field student of soils to seek out these isolated instances and combine them. By such studies he gradually acquires a knowledge of soil adaptabilities. To this extent soil surveys may legitimately go beyond the first step in fundamental work.

ORGANIZATION.

The organization and work of the Bureau of Soils have been along essentially the same lines as during the previous year. The interest in the work of the Bureau of Soils is growing rapidly and the demands for work in different parts of the country are increasing, and it is believed that the results of the work in showing the conditions and resources of the soils of the country and in giving the people precise and accurate knowledge as to the possibilities of the soils justify fully every expenditure that has been made and every recommendation that will be made for the further extension of the work.

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PROGRESS OF THE SURVEY IN THE WESTERN DIVISION.

In the States of the Great Basin and Pacific coast the soil survey has been brought to play an important rôle in connection with the settlement and the utilization of the soil resources of the districts studied, as well as in the development of state and federal projects.

In the State of Washington the survey of an area of 3,568 square miles has been completed. This survey covers large areas of logged-off and burned-over forest tracts adjacent to Puget Sound and embraces the compilation of maps indicating the adaptation of soil types to the various systems of cropping and to reforestation. This State is now confronted with the problem of developing vast areas of such unutilized, unproductive tracts, a considerable portion of which have been returned to the State for unpaid taxes. The work of the survey, which has been undertaken in cooperation with the State, will require three or four more seasons for its completion and is expected to provide a basis for the organization of practicable means for rendering state aid in the clearing and development of the lands, including reforestation of such tracts as are found unsuited to agricultural purposes.

At the request of the United States Reclamation Service a detailed soil survey has been made of the Truckee-Carson reclamation project in Nevada. The results when published will form a ready means of supplying information to home seekers and be valuable in aiding and directing settlement of the government and private lands under the project now supplied with water for irrigation. The report will also be of service to the settlers in pointing out the soil types upon which the various crops are most likely to succeed.

In Oregon an area representative of the humid coastal valley districts in the vicinity of Coos Bay has been studied and mapped. Owing to favorable climatic conditions and to the lack of suitable transportation facilities for more perishable products, dairying is here now the dominant agricultural industry. Certain soil types have, however, been found suitable to the development of special fruit, small fruit, and trucking industries as soon as favorable transportation and market facilities obtain.

In California similar studies have been carried into the Livermore Valley, an important intermountain valley of the Coast Range noted for the production of sugar beets, hops, and choice wines, while in the dry-farmed grain-producing districts of the San Joaquin Valley the scope of the soil survey has been extended to include the agricultural portions of Madera County. In the former area the results obtained are valuable as data bearing upon the relation of soils to a number of special products grown here; in the latter many soil types varying widely in texture and other characteristics have been recognized. Many of these when developed by future irrigation enterprises will become suitable to the production of a wide variety of staple and special farm, orchard, and vineyard crops.

RECONNOISSANCE IN THE GREAT PLAINS AND SOUTHERN TEXAS.

During the last few years a great deal of attention has been directed to the utilization of the Great Plains region as a farming country. Good crop yields throughout the United States, together with the

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high prices obtained by the farmer for his products, have resulted in an era of great prosperity, and this with the increase in population has caused high prices for farm lands, especially in the central-western States. The demand for land, especially for cheaper land, has been great, and the eyes of many farmers have been turned westward and immigration has forced its way into the semiarid region heretofore used mainly for grazing. In order to meet the demand, great bodies of western lands have been thrown on the markets. Large ranches have been cut up into small farms and sold to farmers, and practically all of the cultivable government land has been homesteaded. Many individuals, companies, and corporations are exploiting and advertising the western lands, and the influx of settlers into the western plains has been enormous within the past few years. Many inquiries are received by the Bureau of Soils from people who are contemplating moving into the western country for the purpose of farming and from people already living in the West who are desirous of obtaining information concerning soil problems.

In order to gather information along soil lines which would be available for the people of the West and for the people who wish to move to the West, the Bureau of Soils in 1898 inaugurated extensive surveys in the Great Plains. The importance of gathering the information as rapidly as possible was recognized by the Bureau and it was decided to make rapid surveys of large areas, mapping the soils on small-scale maps. Thus the beginning of the fiscal year 1908 witnessed the beginning of reconnoissance soil surveys.

The purpose of the reconnoissance soil survey is to map the soils in a general way, without attempting to show small areas or trace out soil boundaries accurately, as is done in detailed soil survey work. In some cases where small areas of different soil types are found closely associated and where separating them on a map would require considerable time, these types are mapped in one color, but each described separately in the report. The surface features are also shown in a general way. Soil and general agricultural information is gathered and the report of the area is written up in much the same way as the report for a detailed survey.

In the reconnoissance survey a large area may be covered in a single season. At the close of the fiscal year ending June 30, 1910, approximately 1,132,586 square miles had been covered in the Great Plains region and southern Texas.

These surveys covered the western half of North and South Dakota and three large areas in Texas; one in the extreme northwestern part of the State covering the Panhandle section and two areas in the extreme southern part of the State bordering the Gulf. A great deal of information relating to soils, crops, and agriculture in these sections has been gathered in this work, furnishing material for unbiased reports on the several areas.

In North Dakota some 29 types or conditions of soil were shown. As a rule, all the types that are tillable are well adapted to the production of wheat, oats, flax, barley, and potatoes. These soils are all quite productive and suited to dry farming, provided the rainfall for the year does not fall greatly below the normal. The country has been settling rapidly during the past few years with an industrious class of farmers, many of whom are emigrants from the Scandinavian countries, and from Russia, Germany, and Bohemia. In some

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sections considerable land has been homesteaded by Americans for speculative purposes and only enough work done to comply with the homestead laws. The ranching industry has been largely broken up by the encroachment of the homesteaders and is now confined principally to the rough, untillable areas. This survey showed that nearly 2,750,000 acres, or over 10 per cent, of the land in North Dakota west of the one hundredth meridian is too rough and broken for profitable cultivation and will always be suitable for ranching purposes only. Nearly 2,000,000 acres of this consists of the famous Bad Lands. Many people have homesteaded land where a large proportion of the surface is too rough for farming and they will not be able to depend on crop production, while 160 acres is too small a unit for stock raising. The precipitation is near the minimum for profitable crop production and years of drought may be expected when crop yields will be very slight. A combination of stock raising and farming is safer than depending on grain growing alone, but the farms will have to be larger than 160 acres in order that a suitable system may be evolved. A very large proportion of the land is not suitable for irrigation, and dry farming will have to be depended upon in raising crops for the greater part of western North Dakota.

South Dakota.—About one-fifth of the land, or roughly 5,500,000 acres, in western South Dakota was found too rough for profitable cultivation and suitable only for stock raising and forestry. Much of this rough land is comprised in the Black Hills region. Large areas of the region are still held as Indian reservations. Some of these have been recently opened up to settlement and great numbers of people have come into the region, principally from the Middle West. The soils range from sands to loams and clays. The greater part of the area will have to be farmed without irrigation. Considerable land has been taken up that is not suited for the crops that are adapted to the region, being either too rough or too sandy for profitable cultivation of grain crops. Agricultural and climatic conditions are much the same as found in North Dakota.

Texas.—In southern Texas a large number of soils were found well adapted to many crops. Owing to uncertainty of rainfall in that portion of southern Texas west of the ninety-seventh meridian, irrigation must be practiced when possible to insure profitable crop production. This is done to a considerable extent in the vicinity of the Rio Grande. The soils are well adapted to cotton, corn, vegetables, truck crops, sugar cane, and rice. This country is being sold to many people who move here in order to escape the cold winters of the north. Land values here have risen greatly in the last few years and many large ranches have been cut up into small tracts for farms. Some land is sold in 5, 10, and 20 acre tracts under the advertisement that it is possible to grow truck and oranges or other tropical fruits and make money on such small areas. This may be possible in some of the more favored localities, and the reconnoissance survey has outlined the soils adapted to the different crops and gives information valuable to the homeseeker. The results of the survey seem to show that the production of profitable crops of the tropical fruits is uncertain, except where protected to some extent, although the soils are well suited to some of these fruits.

The Panhandle region of Texas has seen a remarkable influx of American farmers in the last few years. The total value of property

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assessed has risen from about $37,500,000 in 1905 to over $109,000,000 in 1909, according to the statistics of the Texas department of agriculture. This remarkable increase has been largely due to the increased value of land. The reconnoissance survey of that region disclosed a large percentage of good soil well adapted to a number of forage crops and, during favorable seasons, to the various small grains, including wheat and oats. Considerable of the region is rough and broken and adapted only to grazing. The survey has also shown the location of the soils adapted to many crops and the portions of the area best suited to the production of cotton and Indian corn, as well as other crops.

The reconnoissance survey of the Great Plains has been the means of gathering a great store of information regarding soils and soil conditions, the adaptability of certain crops to the different soils, and the best methods of handling the soils in order to conserve the soil moisture, the general lack of which has heretofore constituted the greatest hindrance to a proper development of the Plains region. The results of the reconnoissance soil survey seem to show that in general there is a rather exaggerated opinion of the profits in farming in the West under semiarid conditions where irrigation is not possible. This is perhaps due in part to a great deal of advertising, picturing in glowing terms the possibilities of agriculture, which does not represent average conditions but cites results secured under the most favorable conditions; in other words, the exceptions. This has given rise to a speculation in land that has often resulted in higher prices being asked for the land than conditions would seem to justify. Information gathered by the reconnoissance surveys also seems to indicate that the farms of many portions of the Plains region should be several hundred acres in size and that a combination of general farming and stock raising should be carried on, especially in the regions where irrigation is not possible.

The value of the reconnoissance soil survey may be summed up as follows:

1. Information is gathered and supplied to the home seeker, enabling him to understand thoroughly the conditions in this new country and showing him the location of the soils adapted to the type of farming in which he desires to engage.

2. Information is gathered and furnished the farmers living in the region which aids them to overcome the bad effects arising either from some inherent soil trouble, such as alkali, poor drainage, or mistake in crop adaptation, or arising from improper tillage methods during seasons when climatic conditions are not favorable.

3. It furnishes a broad and comprehensive basis for the future scientific work of National or state agricultural scientists in studying not only soil problems, but general agricultural problems.

CHEMICAL AND PHYSICAL LABORATORY INVESTIGATIONS.

The laboratories have made a large number of physical, chemical, and mineralogical analyses and examinations for the investigations of this and other bureaus, for other departments, and in response to other properly accredited requests. Methods for soil examinations have received more than usual attention, particularly physical and mineralogical methods, which will much facilitate future work. The

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well-known "alkali bridge" which was introduced by this Bureau has been remodeled and a much improved instrument is now available for field and laboratory work. The general lines of investigation have been continued, but among the special results of the year's work attention may be called to the following:

Certain soils from southern China, in the Province of Fukien, which are famous for the production of a high-grade tea, were examined. These soils do not simulate very closely any of the types yet encountered in this country, their nearest prototypes in this country being the Cecil and Durham soils of the southern Piedmont and certain soils in Oklahoma. Although these Chinese soils are reported to have been under clean cultivation for thousands of years and without fertilization, both mineralogical and chemical examination showed that they had a content of the so-called essential plant-food elements decidedly higher than the average American soil, and the examination of them has a considerable value as affecting correct ideas of soil fertility. Further light on the general problem, showing the wide distribution of mineral elements in the soil, is afforded by another of the Bureau's investigations of the past year, in which it was shown that the element barium is to be found in nearly all soils from every part of the United States, but appears to be especially abundant in the feldspar grains of certain soils in the Great Plains areas. The phosphates of lime which may be expected in the soils of all parts of the country and have an especial interest as fertilizers have been further studied and important information gained regarding the nature of the phosphates which can exist under different conditions. At the same time, in collaboration with the United States Geological Survey and the Land Office, the phosphate deposits of Utah, Idaho, Wyoming, and Florida have been investigated and important results obtained regarding their nature and importance as a future source of supply for American agriculture. Especial attention is being given to the utilization of the lower grade material, which under present mixing methods is largely wasted. The fixation of atmospheric nitrogen in form suitable for use as a fertilizer has been studied with a view to determining the possibility of other methods of manufacture than those now in commercial use. It appears that a number of methods are theoretically possible, but all involve practical difficulties, the most important of which is a cheap source of power. The color of soils has been studied, and it has been shown that most soils can be readily classified in this respect and that color has not only considerable theoretical importance in determining the origin and methods of formation of the soil, but is generally of practical importance as indicating the character of physical and chemical conditions determining the crop adaptations of the soil. It is very well known that lime greatly affects the solubility of the organic substances in the soil. Though not so well known, it is nevertheless true that conversely the solubility of the lime is greatly affected by organic matter, as established by some investigations the Bureau has been conducting. More important, perhaps, has been the determination of the chemical nature of the solid substances formed. The phenomena of flocculation and sedimentation are still under investigation, not only because of their importance in soil transport and deposition, but also because of the relation to the important problems of soils crumbing and tilth.

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Studies on these latter are in progress, not only as they are affected by mechanical agencies but as they are affected by all cultural operations, especially fertilization. Substantial progress has been made in showing that profound physical effects are produced in soils of quite as great signification for crop production as are the chemical changes and that methods are now available for studying these physical changes. It has been shown that certain properties of the water, such as its density, which influences its movement in soils, is greatly changed by the addition of salts. The optimum water content is also altered by such additions, and in fact all the relations between the solid soil particles and the soil water.

Finally, these studies have led to the formulation of the soil properties affecting crop production as a dynamic system involving dependent factors only. The chief importance of this formulation is that it points out the way for more systematic studies of the soil than have been possible hitherto, indicates the relationships of the numerous factors determining crop production, and brings clearly to mind that it is the changes these factors undergo and the control of these changes by cultural operations that are of importance, rather than a static inventory of the soil materials.

SOIL-FERTILITY INVESTIGATIONS.

During the last year considerable progress has been made in the lines of work pursued in connection with soil-fertility investigations. The new point of view which has been brought to bear on the problems connected with the fertility of soils has opened up avenues of profitable investigation and already forecast results of great economic importance.

The biological relationships existing in soils have received special attention, as the importance of such relationships can hardly be overestimated. It has been found that the soil can not be considered as the dead, inert remains of rocks and previous vegetation, but must be considered as the accumulation of such material in which the processes of formation, alteration, and transposition are still at work. The soil in its entirety is not dead or inert, but endowed with functions analogous to life itself. In the soil there take place the same processes of solution and deposition that have taken place in past ages and are taking place to-day in the geologic processes connected with the action of water on the rocks and minerals of the earth's crust. There take place in the soil the same physical and chemical interaction as take place in the movement of surface waters generally, resulting in ore formations or depositions. These researches have shown that in the soil there take place likewise the same processes of fermentation, digestion, or decay of organic materials as take place in animals and plants or in the production of industrial products, such as cheeses, wines, beers, etc., brought about in the soil as in these other processes by means of ferments, enzymes, bacteria, fungi, or molds. These biochemical studies have likewise shown that in the soil there take place the same processes of oxidation and reduction which play so vital a part in all life processes and that the nature of compounds in the soil organic matter are the same as those derived from such life processes or from similar laboratory processes of digestion, oxidation, or reduction.

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In these researches it has been found that the soil instead of being an inert reservoir is the seat of physical, chemical, and vital actions which directly or indirectly influence soil fertility. The roots of plants and plant débris, with their biochemical activities, microorganisms, worms, enzymes from various sources, catalytic action of organic and inorganic matter of the soil, the relation of the various activities and the effect of fertilizers upon them, and the processes going on in humus, all play an important part in the soil's fertility. These investigations have shown that the roots of higher plants are not simply absorbing organs, but possess the power, through oxidation, reduction, and otherwise, to make changes in the soil ingredients—changes which are undoubtedly modified by various compounds, organic and inorganic. The various fertilizing salts commonly used, besides serving as nutrients for plants, are doing work in the soil, as are also the various soil constituents themselves, modifying the various reactions in a complex, ever-changing medium, and in particular modifying the kind, the number, and the activities of the microorganisms. These are present in vast numbers, especially in cultivated soils, associated with the organic matter, and exercise important functions, both good and bad, in connection with the higher plants. The biochemical side of soil fertility investigation has been little studied in the past, but it is only through this that a thorough insight into the problems of soil fertility can be obtained. Whatever adds to our biochemical knowledge of soil, advances and broadens our understanding of the complex problem of soil fertility.

The organic matter of the soil and the biochemical relationships involved are of the utmost importance. Organic matter is essential to make a soil of what would otherwise be pulverized and more or less hydrolyzed rock, and while there are some soils capable of growing crops that contain very small quantities of organic matter, on the whole, the quantity of this material in average soils is considerable. The average organic content of soils amounts to 28 tons per acre in the first 8 inches of soil and 50 tons in the soil and subsoil together to the depth of 2 feet. In regard to this organic matter it has been believed for many years that it consisted chiefly of some such body as humic acid, differing perhaps in different soils, but having the same general properties. One prominent service which these investigations have rendered agriculture has been to show the nonexistence of humic acid and its hypothetical relatives.

In considering the importance of the organic matter of the soil it should be borne in mind that it is material that is the result of change, and that much, perhaps all of it, is susceptible of still further change; that is, it is in the transition stage. The changes which it has undergone and changes which it may still undergo are determined by a number of factors, chief of which are moisture, aeration, character of microorganisms, and mutual relation of the organic compounds and the mineral constituents. These factors are many of them influenced or controlled by cultural methods, including fertilizing, drainage, irrigation, inoculation, etc., used in practical agriculture. The operations of irrigation, conserving of moisture by mulches, aeration by cultivation, inoculation with cultures of bacteria, addition of organic and green manures, are all common agricultural methods used by farmers and they are also operations that influence the chemical changes which soil organic matter undergoes.

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Isolation in a pure condition of some of the organic constituents of soils has made possible the correct interpretation of soil changes and the discovery of compounds harmful to crops. This harmful effect has already been emphasized in former reports. This line of research has been especially profitable during the last year and has led to the isolation of more than twenty compounds. The classes of materials found are the fats and oils, fatty acids, hydrocarbons, carbohydrates, esters and alcohols, as well as many nitrogenous compounds. Some of these compounds consist of carbon and hydrogen only; some contain carbon, hydrogen, and oxygen; some carbon, hydrogen, oxygen, and nitrogen; and still others, in addition to these, sulphur and phosphorus.

Prior to this investigation not a sing.e organic constituent of the soil was known. All the hypothetical compounds designated as humic acids have been shown to have no definite existence. In carrying out these researches great difficulties had to be overcome. The results thus far obtained are very gratifying. This knowledge of soil constituents is of the utmost importance to every soil investigator, whether he be a chemist, a bacteriologist, or a physicist studying some special problem, or an agronomist, dealing with the general relations of soils to crops. The organic matter of soil is ever changing. On it work bacteria, molds, and other life within the soil, obtaining therefrom their existence and producing in turn other compounds and by-products beneficial, harmful, or innocuous, according to the kind of organisms or soil conditions under which the actions take place. The organic compounds modify all other chemical interactions, influencing absorption, the movement of the soil solutions, and the water-holding power of soils, and this definite information is therefore of the greatest interest in giving direction and definiteness to many lines of soil investigation and soil management.

These researches into the nature and properties of soil organic matter have shown conclusively that the soil investigator must take into consideration the presence of organic compounds in the soil, which may be beneficial, harmless, or inimical to growing crops. The presence of the harmful compounds may cause, according to their specific action or to the amount in which they are present, all stages of crop depression from effects probably in many cases so slight as not to be noticed in actual difference in yield, although perhaps in quality or keeping quality of special crops, to the more marked effects when practical sterility is observed. A complete solution of the difficulty which the presence of such bodies may occasion the practical tiller of the soil can only be reached by thorough inquiry into the chemical and biological nature of such compounds, by a knowledge of their origin and the causes leading to their formation or accumulation in the soil, and by an investigation into treatments of the soil—chemical, such as the addition of fertilizers, lime, etc.; physical, such as drainage, cultural methods, etc.; or biological, such as the influence of crops and their remains on the soil, crop succession or crop rotation, number and kind of bacteria, fungi, etc.—to the end that the best practical means for their removal, destruction, or prevention may be determined and soil treatments

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be more scientific in the future than in the past, with consequent greater and surer returns for the money and labor expended.

An especially valuable line of research has been the study of the action of some of the compounds isolated from soils on plants, without fertilizers and also with various ratios of fertilizers. In these investigations it has been found that some of these isolated bodies are decidedly harmful in their effects on plant growth and that this harmfulness consists not only in the dwarfing or killing of the plant, but that the process of absorption of nutrients is very seriously interfered with, so that even in the presence of large amounts of nutrient elements the plant can not obtain its full amount of nutrients when the harmful body is present. It has further been found that while the fertilizer salts ameliorate the harmful effect, they do not entirely overcome it. The most interesting factor of this work has been the discovery that certain harmful compounds are overcome most by the mainly nitrogenous fertilizers, that others are influenced most by potassic fertilizers, and still others are influenced most by phosphatic fertilizers.

The action of fertilizers on soils is a much contested question, but the weight of evidence is against the assumption that their effect is due altogether to the added plant food. If so simple an explanation were a true one, nearly a century of investigation of this problem by scientists of all civilized nations would surely have produced greater unanimity of opinion than now exists in regard to fertilization. Thoughtful investigators everywhere are finding that fertilizer salts are influencing many factors which contribute toward plant production besides the direct nutrient factor for the plant. It is this additional influence of fertilizers which makes them doubly effective when rightly used. To this influence of fertilizers on soil and biological conditions is due their capriciousness when applied on the the theory of lacking plant food and any study which throws light upon the mooted question is of direct help toward reaching that view of soil fertility and soil fertilization which will eventually result in a more definite system of fertilizer practice, to the end that surer and safer returns shall be obtained from their use. This will tend to extend fertilizer practice by making it more remunerative and rational than in the past.

SOIL-WATER INVESTIGATIONS.

The soil-water investigations were continued in field and office throughout the year. The later field work has lain largely in Kansas, Colorado, and California. Western Kansas (in which a reconnoissance soil survey has just been completed) and eastern Colorado form a typical part of the Great Plains sloping eastward from an average altitude of some 5,300 feet at the base of the Rockies to, say, 1,800 feet, or at the rate of 10 feet to the mile. The underlying formations are largely Cretaceous sandstones and shales; these are overlain by heavy deposits of sands, gravels, and loams which form the soils and subsoils. Both the Cretaceous formations and the overlying deposits are pervious in varying degree, and throughout the region ground water is found at a limited depth below the surface; where the materials are sufficiently pervious to permit free movement this ground water supplies wells, and frequently where

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the surface is relatively low the wells are artesian. The chief purposes of the investigation were, first, to ascertain the source of the ground water, and, second, to ascertain its relation to the soil. The observations coupled with the office research render it clear that the ground-water supply is derived partly from locally absorbed rainfall, but largely from the greater rainfall of the mountains absorbed by the westerly outcrops of the strata and carried in accordance with artesian principles thence eastward, the water rising under its hydrostatic head from one porous stratum to another in such manner as to approach the surface. The entire mass of the formations and deposits are thus kept saturated, and the water of saturation may be likened to a reservoir with a surface inclining eastward about 10 feet per mile and flowing through the strata at a rate determined by their perviousness, the surface of the reservoir coinciding with the land surface in the permanent stream valleys and in certain basins containing permanent ponds. Over perhaps a quarter or a third of the area this ground-water reservoir approaches the surface to within the limits of capillarity, and here it supplies the requisite moisture for plant growth, and except in restricted areas it is within reach of flowing or pump wells. This subsurface supply is especially important in connection with dust mulching, or "dry farming," since this device for checking evaporation permits the moisture to accumulate against the season of growing crops. On the whole the investigations show that the ground water of the plains is an important resource, without which this vast area would be far less productive and habitable than it is.

The field work was extended into Uncompahgre Valley in Colorado, and into a part of California Valley, in order to ascertain the quantity and movement of ground water in intermountain valleys in its relation to the soil. In both valleys it was found that the ground-water supply, collected largely from adjacent mountain slopes during storms, exists in sufficient quantity to yield artesian flow in places, and to approach the surface to within reach of capillarity elsewhere. The researches render it clear that throughout both the plains and the mountain regions natural subirrigation through the movement of ground water, while hitherto unrecognized, is an important factor in determining the constitution and productivity of soils.

The field work extended also into the Southern States, where the destructive effect of soil erosion is great. In addition to records and photographs illustrating the destruction, attention was given to protective devices, and the data were incorporated in a paper on "Soil Erosion," transmitted during the year for publication.

Attention was given also to the rôle of water in affecting the constitution and productivity of soils and the quantity of water required for the best results in production. In this connection a coefficient for the agricultural duty of water, expressed in terms of production, was worked out. The results of this work also have been transmitted for publication.

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REPORT OF THE ENTOMOLOGIST.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY,
Washington, D. C., August 8, 1910.

SIR: I submit herewith an executive report covering the work of the Bureau of Entomology for the fiscal year ending June 30, 1910, dividing it, in accordance with your instructions, under the following headings:

(1) A summary of the important operations carried on during the fiscal year ending June 30, 1910.

(2) An outline of the plans proposed for work during the fiscal year ending June 30, 1911, under appropriations already made for that year.

(3) Plans of work recommended for year ending June 30, 1912.

Respectfully,

L. O. HOWARD,
Entomologist and Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

WORK OF THE YEAR.

The work of the year beginning July 1, 1909, and ending June 30, 1910, may be classified, as was the case last year, as follows:

(1) Work on the gipsy moth and the brown-tail moth.
(2) Importations of useful insects.
(3) Exportations of useful insects.
(4) Work on insects injurious to southern field crops.
(5) Investigations of insects damaging forests.
(6) Investigations of insects damaging deciduous fruit trees.
(7) Cereal and forage-plant insect investigations.
(8) Work on insects affecting vegetable crops.
(9) Work on insects affecting citrus fruits.
(10) Investigations of insects in their direct relation to the health of man and domestic animals.
(11) Work on insects injurious to stored products.
(12) Inspection work.
(13) Work on bee culture.
(14) Unclassified work.

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FIELD WORK AGAINST THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

The work against the gipsy moth and the brown-tail moth during the fiscal year ending June 30, 1910, has been continued along lines similar to those used in previous years, with a few modifications and additions. The infested area is somewhat larger, but the rate of increase is proportionately less than it has been in any year since the beginning of the work. Except for the finding of a bad colony of the gipsy moth at Wallingford, Conn., all the additions to the territory have been contiguous to the previously infested areas. The cooperation with the state authorities in the infested States has been most cordial and effective, and the livable conditions in the older infested areas are better than at any previous period since 1900. This means that the streets, roadsides, and cultivated lands are measurably free from both pests. Spread has been in forested areas, and looking away from the roadsides toward forested hillsides it was possible at any period during July to find large ranges of browned trees indicating the almost total removal of the foliage. As indicated before, however, the death of forest trees does not necessarily follow a complete defoliation in July, since the coming of rains in August brings out another crop of leaves, thus saving the trees from asphyxiation. Moreover, it is becoming evident that it is only rarely that the same area is completely defoliated two years in succession. It much more commonly occurs that the bulk of the caterpillars in a large infestation bringing about complete defoliation die as the result of disease from overcrowding, or from starvation owing to the complete destruction of food; hence the following season the new infestation begins on the borders of the old one, and contiguous rather than identical areas are defoliated.

The work, as in the past, has been confined chiefly to the gipsy moth. The infested area in New England is now little more than 10,500 square miles.

There has been little increase in the area infested by the brown-tail moth within the past year. The territory which this insect is now known to inhabit is about one-third of the extent of New England.

WORK IN MASSACHUSETTS.

The work in Massachusetts has been principally in the way of keeping the most traveled woodland roadsides through the worst-infested areas clear of the gipsy moth, and has been a continuation of previous work in nearly every direction, except south, where the conditions are not so serious as they are north and west of Boston. The roadsides which have been cared for more than one year are in such condition as to require a constantly lessening annual expense, and in a few instances additional work may be discontinued, since the roads are so clear that the towns are willing to care for them themselves. It seems that the Bureau may be able to induce the towns to take over more of the work which it has been caring for. As shown in previous reports, the strip on either side of the road which has been cleaned up has been 100 feet in width. Experimentally during the past year in several instances this width has been reduced to 75 and 50 feet. If these narrower belts prove to be effective in keeping the caterpillars from roadways, an extension of the number of miles of roadsides covered can be gained with the same appropriation.

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Spraying operations were begun at the end of May and continued to the end of the fiscal year. Ten large spraying machines were kept at work in Massachusetts on the roadsides through the worst-infested woodlands, and some work was done in New Hampshire. The spraying was not so successful this year as last, on account of the unusual number of rainy days, the rain preventing the application of the poison and washing off much of that which was applied.

WORK IN NEW HAMPSHIRE.

No summer work was done in New Hampshire in 1909, but in the latter part of October scouting operations were begun, and an effort was made to keep 100 men in the State during the winter; but it was not easy to maintain this number on account of the difficulty of getting men who were willing to leave home. A severe blizzard and snowstorm late in December coated the trees and covered the ground to such a depth that scouting operations had to be discontinued temporarily. The work was continued into June, 1910. All of the previously known infested territory was scouted, but not so thoroughly as in previous years, the seriousness of the infestation in the southern part of the State rendering it desirable to spend the time in applying creosote to the egg clusters along the roadsides. The orchards and woodlands away from the highways were not touched.

During the fiscal year 1908–9 about 50 towns were added to the infested area; the present year 21 were added as the result of this careful scouting. In several of these new towns only single egg clusters were found, and in none of them were there any large colonies. There are at present 121 infested cities and towns in New Hampshire, with an area of about 3,500 square miles. There seems to be little hope of controlling the gipsy moth in New Hampshire until a local organization is effected in each city and town, under state supervision, and a constant concerted effort is begun. The scouting operations were continued outside the area found to be infested, in order to make certain that there has been no further spread.

The brown-tail moth situation in New Hampshire was found to be serious. The winter nests were removed from the highway trees in most of the towns, and many property owners cut them from orchard and shade trees near their dwellings, but here again there is necessity for concerted state and township work.

WORK IN MAINE.

In Maine the trees in the infested localities were burlapped and tended. The worst places were sprayed. In most of the woodland colonies the underbrush has been cut out and the trees put in the most favorable condition possible. Scouting operations were continued throughout the winter and spring months. Four towns were added to the infested area, but in these only incipient infestations were located, the worst one being at a market garden in South Portland, where 22 egg clusters were found and treated with creosote. All of the known infested localities in this State are in shape for future work. The territory now known to be occupied by the gipsy moth in Maine is about 800 square miles. The gipsy moth colony previously existing, and referred to in earlier reports, at Soldiers' Home,

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Togus, Me., may be considered as exterminated, no evidence of the moth having been found for nearly two years.

During the past winter considerable woodland scouting was carried on, and large gipsy moth colonies were located in a few places, the worst one being on the eastern slope of Agamenticus Mountain, in the towns of York and Wells. Several thousand egg clusters were treated with creosote in this colony, and the ground was cleared up over several acres. A smaller colony was located near the summit of the mountain. Several woodland colonies were located in the Berwicks, but Maine conditions in general are not bad.

The brown-tail moth seems possibly to have reached the northern limit at which it can thrive in Maine, which is about the forty-fifth parallel of latitude. Although the moth has been known to be present up to this line for two or three years, it does not appear to increase materially. This statement must not be taken as a prediction that the brown-tail moth will not extend north of this region, but simply as a statement of observed fact down to the present time.

WORK IN RHODE ISLAND.

The area infested by the gipsy moth in Rhode Island has decreased slightly during the past year, and the moth is less abundant than at any time since its control was undertaken. The Bureau work in this State has been in cooperation with the state officials. The state appropriation is used until it is exhausted, and then such of the force as is necessary to keep up the work is carried on the federal pay roll through the season. The creosoting of egg clusters and the burlapping of trees has been the principal work. A little brush has been cut and a great many trees have been cemented or patched with tin to lessen the number of hiding places for the caterpillars and egg clusters.

The brown-tail moth has been more in evidence in Rhode Island during the past year than before, and now occurs in about one-fourth of the State—the northeastern portion—although here it is not as prevalent as in Massachusetts, New Hampshire, and Maine.

WORK IN CONNECTICUT.

The gipsy moth colony at Stonington is nearing extermination. Less than 100 caterpillars were taken there during the summer of 1909 by the state force. Early in December some of the best scouts employed by the Bureau were sent to this State to assist the state authorities in the search for egg clusters, the combined efforts resulting in the discovery of but one. While this colony will need watching for some time, it seems probable that another year or two should result in its complete eradication.

In December, 1909, a bad colony of gipsy moths was discovered in the town of Wallingford, about 12 miles north of New Haven. The State immediately took steps to do the necessary work, and a little later a force of Bureau scouts was sent down from Massachusetts to examine the territory outside of the lines of the original colony. Every tree in Wallingford was examined, except the woodland, and no egg clusters were discovered except a few near the border of the colony, as at first outlined. The scouting operations were continued

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in the towns of Meriden, Berlin, and New Britain, but no evidence of the existence of the gipsy moth has been found in these towns. It is hoped to continue this line of scouting operations to the Massachusetts state line in the towns through which a great deal of traffic passes from the infested area in Massachusetts to New York. This is one of the principal automobile routes in New England. All effort to ascertain how the gipsy moth reached Wallingford has been vain. The colony has existed for about three or four years, and possibly longer, entirely undiscovered until last December. About 10,000 egg clusters were destroyed before hatching time. The State is doing all of the work in the infested area.

The brown-tail moth has been reported from Thompson, in the northeast corner of the State, and also at Putnam, a few miles south of Thompson. It is possible that this region south of the Massachusetts line is rather generally infested.

GENERAL CONSIDERATIONS.

There have been employed throughout the year from 300 to nearly 500 men. First-class men have been difficult to get, and in February an increase was made in the wages of all of the older men, of from 1 to 3 cents per hour. There have been in use 10 gasoline-power spraying machines, of 400 to 500 gallons capacity, capable of discharging 3,000 to 4,000 gallons per day, and about 40 tons of arsenate of lead have been used during the past spraying season.

The use of burlap bands for trapping the caterpillars on the tree trunks has been discontinued, and tree tanglefoot has been substituted, 20 tons being used during the summer work of 1910. In an effort to reduce the cost of this operation, similar substances have been introduced from Europe, but have not proved to be as effective as the tanglefoot in the prevention of the crawling of the caterpillars.

Some investigations have been begun in regard to certain points connected with the life history of both the brown-tail moth and the gipsy moth, which, although hitherto considered settled, now seem open to some doubt.

The principal subject of this kind which has received attention has been undertaken in an effort to explain the presence of the gipsy moth in isolated woodland colonies which it could not possibly have reached by the crawling of the caterpillars and which it is most unlikely to have reached by being carried accidentally on the garments of persons penetrating the woods. Thus a series of experiments has been carried on in a most careful way to determine whether the newly hatched gipsy moth caterpillars may be distributed by the wind, and it has been possible to prove during the summer that the newly hatched caterpillars have been carried in this way over a distance of 1,800 feet.

The methods used in the entire work, together with new observations bearing upon the work, have been summarized in a bulletin about to be published, entitled "Report on the Field Work against the Gipsy Moth and the Brown-tail Moth," by D. M. Rogers and A. F. Burgess. One new point brought out is that August spraying is an excellent method for the control of the brown-tail moth. The collection of the winter webs, which is the method universally adopted in Europe and which has also been generally practiced in this

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country, necessitates the constant cutting back of the twigs and smaller branches, which, where the moths are so plentiful as to make their webs upon almost every twig, must be to some extent injurious to the trees.

Although there is a general section in this report devoted to inspection work, it is proper here to mention the efforts made to prevent the further dissemination of the gipsy moth from the infested territory by the cooperation of the different railroads running through this territory. Beginning with the fiscal year 1909–10, the several railroads issued a notice to all of their station agents (about 600 in number) within the infested area to the effect that forest products, such as lumber, cord wood, railroad ties, telephone poles, etc., would not be received for transportation unless accompanied by a permit or a certificate of inspection. The effect of this order was some disturbance to shippers for a time, but, as they learned the object of the inspection and saw the possiblity of relieving others of similar inconvenience, they have gladly cooperated. A trial of this plan indicated that it was nearly impossible to inspect all of the material offered for shipment, and permits were granted without inspection for the transportation of forest products from one infested locality to another infested locality, but all of the products intended for shipment beyond the infested territory were carefully inspected and all egg masses were destroyed before the material was moved and before a certificate was granted to the shipper. In December, 1909, a supplementary order was issued by the railroads to their station agents stating that forest products for shipment from one station to another within the infested territory might be received and shipped without permit or certificate. This order properly gave a list of the stations on the several roads between which material might move, but forbade the transportation of forest products from the stations listed to stations not listed, except when accompanied by a certificate. Three thousand four hundred and seventy-five applications were made for shipment, and 2,751 permits were granted, 724 certificates being issued. This system has worked fairly satisfactorily, although it is not perfect.

The actual field work just described has been carried on under the direction of Mr. D. M. Rogers, as in previous years. Mr. Rogers's headquarters are at No. 6 Beacon street, Boston.

IMPORTATIONS OF INSECT ENEMIES OF THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

The principal efforts of the Bureau in importing useful insects during the fiscal year 1909–10 have been in connection with the importation of the parasites and predatory enemies of the gipsy moth and the brown-tail moth from other parts of the world. This work has been in cooperation with the State of Massachusetts, and the parasites have been received at the Gipsy Moth Parasite Laboratory, supported by the State, at Melrose Highlands, the care of the parasites and their distribution being assigned to the Bureau of Entomology. The laboratory has been increasingly busy and increasingly effective, and during the fiscal year has employed 23 assistants, the principal experts being carried on the rolls of the Bureau of Entomology and the others being paid by the State. Mr. W. F. Fiske, of the Bureau, has had direct charge of the work.

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The writer visited Europe in May and June, 1910; visited agents and officials in Italy and France, and, through the courtesy of the Spanish and Portuguese governments, was able to start a new official service in each of these countries for the collection and sending of parasitized gipsy moth larvæ to the United States. In Italy Prof. F. Silvestri, of the Royal Agricultural College at Portici, and Dr. Antonio Berlese, director of the Royal Agricultural Entomological Station at Florence, insisted on the desire to be of service to the United States in this direction and declined all financial aid. In Spain Prof. L. Navarro, of the Phytopathological Station at Madrid, volunteered his services under the same conditions, with the approval of the minister of agriculture. In Portugal, Prof. A. F. de Seabra, of the Phytopathological Station at Lisbon, also volunteered his services with the permission of Senhor Alfredo Carlos Le Cocq, director of agriculture. In France arrangements were made with a paid agent stationed in the south of France, and the same arrangements as in previous years were made with paid agents in Germany and Switzerland. The distributing agency at Hamburg was continued, and a new distributing agency was started at Havre on account of its convenient proximity to the American Line steamers starting from Southampton.

Sendings from Japan were continued in the same manner as during the previous year. The minister of agriculture for Japan, at the request of the Secretary of Agriculture of the United States, again designated Prof. S. I. Kuwana, of the Imperial Agricultural Experiment Station at Tokyo, to be its official representative in the work to be carried on during the spring and summer of 1910. Professor Kuwana continued his most valuable sendings.

The thanks of the United States Government and of the governments of the States involved are due in high measure to the officials of Italy, Russia, France, Spain, Portugal, and Japan who have assisted in this work. All of them have been named at one time or another in this series of reports.

The work of the Gipsy Moth Parasite Laboratory continued uninterruptedly during the year, consisting of—

(*a*) Importation of parasites and predatory enemies from abroad, as indicated above.

(*b*) Rearing these parasites and predatory enemies in the laboratory, and wherever possible breeding them in numbers from imported parent stock.

(*c*) Colonization in the field of the parasites thus obtained.

(*d*) Field work to determine their progress in America.

(*e*) Investigations into their biological and general relations.

(*f*) Field and laboratory investigations into the parasites of native insects most nearly related to the imported pests either in habit or in natural affinity, with especial reference to the probable effect which the introduction of the foreign parasites will have upon the economy of the native parasites and of their hosts.

Larger quantities of the raw material from which the parasites have been reared have been received than during any other year. This has consisted, as heretofore, of eggs, winter nests, caterpillars, and pupæ of the brown-tail moth from Europe, and of eggs, caterpillars, and pupæ of the gipsy moth from Europe and Japan, large numbers of adult predatory beetles, and thousands of parasite cocoons and

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puparia. But, for numerous reasons, although the amount received was larger, the results obtained, owing partly to the condition of the material on receipt and owing to curious seasonal fluctuations and differences in the countries of origin and in the infested territory in America, the results have by no means corresponded with the increased material.

During the year 1909 two important parasites of the gipsy moth (Blepharipa and Parasetigena) were imported in large numbers. They were both hibernated successfully and colonized under ideal conditions in the spring of 1910.

During 1910 determined efforts have been made to secure adequate numbers of several interesting and probably valuable parasites not yet secured in quantities sufficient to provide for satisfactory colonies; but for the most part these attempts seem to have resulted in failure, although the final word can not be said at this time.

As the work goes on there seem to be almost as many disappointments as successes. For example, no less than 1,000,000 of a Japanese parasite of the eggs of the gipsy moth were reared during the summer of 1909 and the winter and spring following, and great hopes were entertained for its success, but from the present point of view it appears to be wholly unable to withstand the rigors of the New England winter, and another egg parasite, a European species, of which several hundred thousand were reared in confinement, does not appear to make an impression upon the numbers of the gipsy moth eggs in America.

On the other hand, success of the most promising character has been reached with others of the imported species. *Calosoma sycophanta*, an imported European predatory beetle, was the first of the imported species to be recovered from the field under circumstances indicative of its ability to exist under American conditions. The season of 1910 is the fourth during which its progress has been conscientiously followed, and during each of these seasons it appears to have combined a steady rate of increase of approximately tenfold with a rate of dispersion in excess of 1 mile a year in every direction from the center of the original colony. A tenfold rate of increase annually means that 100 beetles liberated in 1906 would have increased to 1,000,000 by 1910, and the actual prevalence of the beetle in the field is such as to make this appear a reasonable estimate of the numbers actually existent. They were so abundant in some localities the past year as to affect the gipsy moth materially, although by no means so materially as to meet and overcome the strong reproductive ability of the pest. If, as there is reason to hope, they will continue to increase at this slow but steady rate for some years to come, their effect upon the present prevailing abundance of the moth will be apparent to all.

Another encouraging example is the tachinid fly of the genus Compsilura, which attacks both the gipsy and the brown-tail caterpillars as an internal parasite. This species was first liberated in 1906 and was first recovered in 1909 under circumstances indicative of its establishment in America. During 1909 it was found distributed over about five towns adjacent to the one in which the first infected colony was liberated. It was everywhere rare during that year. In 1910 it was expected that it would show a marked increase, but the actual outcome was in excess of all expectations. Instead of a ten-

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fold increase, which would have been considered satisfactory, there seems good evidence that it increased fiftyfold and perhaps much more. It has about equaled Calosoma in actual destruction of gipsy moths this year, and in addition has destroyed an appreciable percentage of the brown-tail caterpillars, and it is now turning its attention to such native species as the fall webworm, the tussock moth, and other fall-feeding caterpillars. Its increase has been accompanied by a dispersion amounting to 10 or 12 miles in every direction as a minimum aggregate during the four years since its first colonization.

Still another example is the European Monodontomerus, the recovery of which over a large area was made the subject of especial mention in the last report. This species has continued its satisfactory rate of increase and phenomenal rate of dispersion throughout the year. It is well over the border line in New Hampshire, and appears to be extending its range about 10 miles each year, and to be maintaining a twenty-five fold annual increase.

It has been somewhat disheartening in the course of the study of the progress of the parasites in the field to find that certain species liberated under the most favorable conditions can not be recovered the next year; and even in the case of two species, both colonized in 1908 and apparently established in 1909, no traces could be recovered in 1910. But on the other hand another species (Zygobothria), colonized in 1907, was recovered in 1910, three years later, for the first time—in small numbers, it is true, but over a considerable territory, indicating a rapidity of dispersion sufficient to render a material increase unnoticeable for the first two years.

Another encouraging fact which may be mentioned here is that an important egg parasite (*Anastatus bifasciatus*) seemed this summer to have demonstrated its ability to survive the New England winter, and, having been colonized in 1909, appears to be strongly established in 1910.

On the whole, the results of the work are distinctly more encouraging than they have appeared to be heretofore, and we are by no means disheartened over the nonrecovery during the present season of no less than 15 species which have been colonized. In several instances colonization has been much too recent to make their recovery probable, on account of rapid dispersion; and several others have never been received in sufficient numbers to make a strong colony possible, so that it may well be that establishment has not yet been accomplished. It has been found in the course of this work that there is little hope of the establishment of a colony of less than 1,000 individuals, and in many instances, of course, it has been found impossible to put out so large a number.

The insight which is being gained at the laboratory into many points connected with the biology of these important and interesting insects is resulting in practical knowledge that can not fail to be of high importance in the continuation of the investigation. Some changes in plans will be indicated in another part of this report.

OTHER IMPORTATIONS OF USEFUL INSECTS.

The greatly increased damage done in portions of Massachusetts by the European leopard moth, an insect whose larva bores into the limbs of many shade trees, and which at present is confined to eastern

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Massachusetts and to the vicinity of New York City, has rendered it desirable to attempt the importation of some of the known European insect enemies of this species. This effort has been made during the fiscal year, but it is too early as yet to observe any result. Further attempts were made to introduce European enemies of the elm leaf-beetle, but as yet without success.

It has been ascertained that the eggs of the tobacco hornworm in Porto Rico are destroyed by parasites, and in consequence, through the courtesy of Prof. W. V. Tower, a large number of parasitized eggs were sent to Clarksville, Tenn., the headquarters of the tobacco-insect investigations of the Bureau. The parasites emerged in due time, but through some defect in manipulation that may be remedied as a result of future work none of them could be induced to attack the native eggs.

EXPORTATIONS OF USEFUL INSECTS.

Prof. Antonio Berlese, of Florence, Italy, reports the continued spread of the American parasite of the mulberry scale and anticipates complete relief.

Exportations of American coccinellids have been made to Prof. F. Silvestri, of Portici, Italy, for the purpose of feeding upon this same scale insect. These coccinellids have been reared at Portici and have been liberated in mulberry groves at Acerra. The Chief of the Bureau, visiting in Italy in May, 1910, took with him a large box of these American coccinellids, which arrived at Portici in almost perfect condition, and from them Professor Silvestri expects excellent work.

Shipments of the parasite of the brown dog tick were made to officials in South Africa and to Italy.

WORK ON INSECTS AFFECTING SOUTHERN FIELD CROPS.

The work on insects affecting southern field crops deals with the following problems, in accordance with the classification made a year ago:

1. The cotton-boll weevil and other species injurious to cotton.
2. Insects injurious to tobacco.
3. Insects injurious to sugar cane and rice.
4. The Argentine ant.
5. Insects injurious to cacti utilized for food.

This work is conducted, under the direction of Mr. W. D. Hunter, by four trained assistants, located, in so far as possible, in the regions where the loss is greatest.

COTTON-BOLL WEEVIL INVESTIGATIONS.

The growing season of 1909 was very abnormal as regards damage by the boll weevil. Although the infested area increased as usual in the autumn, the damage in general was much less than is to be expected in a normal year. An unusually small number of weevils issued in the spring, owing to abnormal winter conditions. Unprecedented dryness, which began early in the spring, was continued throughout a large part of the growing season and checked rapidity of multiplication. Considerable damage, however, was done in

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southern Texas and in the southern parishes of Louisiana. Considerable damage was done also in Mississippi. A conservative estimate of the loss will be about $15,000,000.

On account of the obviously greater difficulty of the boll-weevil problem in the Mississippi Delta than elsewhere, as pointed out in previous reports, a well-equipped laboratory was started at Tallulah, La., where conditions characteristic of the whole delta region exist, and during the year substantial progress was made in the study of new means of control. Especial attention was paid to the possibility of utilizing parasites of the boll weevil. On account of the scarcity of material for breeding parasites in Texas it was impossible to carry the work as far as was desired. Nevertheless some practical indications of success have been obtained.

An important series of experiments was begun to determine the proper spacing of cotton plants in the field in order to obtain the maximum benefits of the factors in the natural control of the pest, including the parasites. These plats were located at five points in Louisiana.

The chain cultivator, perfected by the Bureau, was tested with especial reference to its adaptability to the peculiar soil conditions of the delta, and a study was made of the possibility of flooding the fields to kill the weevils in their hibernating quarters. This method will probably be practicable in some localities.

In connection with the utilization of the parasites of the weevil a study was made of the relative abundance of the flow of nectar with the different varieties of the cotton plant. This nectar furnishes the only food, so far as known, of the adult parasites. Therefore the cotton varieties that secrete the most nectar may be supposed to attract the parasites which will destroy the weevils. Also the cotton varieties which hold the squares best have been found to be more heavily parasitized than other varieties of cotton plants. Therefore a study of varieties having this habit has been carried on.

Extensive experiments were made in the effort to obtain definite knowledge regarding the hibernation of the weevil in the delta. The results obtained from these experiments will indicate the best time to take the greatest step in the control of the boll weevil, namely, the destruction of the cotton stalks in the fall.

Efforts were made also to ascertain the exact effects of excessive moisture on the hibernating insects, since it has been suggested that the heavy precipitation in the delta region may be unfavorable to the weevil during the hibernation period.

On account of the apparent success of experiments made by the Louisiana state crop pest commission with powdered arsenate of lead, experimental work in this direction has been carried on by the Bureau. Arsenate of lead is a very finely divided powder, and will reach parts of the plants that can not be reached by Paris green or other compounds hitherto used. An effort was made to ascertain how many applications are most profitable and the proper interval between applications. The experience of practical planters in using the poison has been collated. Work of this character was also begun in Texas. An important objection against the use of arsenate of lead is its high price, and, moreover, recent experiments seem to indicate that its effect upon the soil under some conditions may be very deleterious. The Texas experiments include a study of arsenical

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and other poisons made up especially by certain manufacturers in the hope of discovering a cheaper compound and one which at the same time will possibly have less direct injurious effects upon the soil.

TOBACCO-INSECT INVESTIGATIONS.

The section of the southern field-crop insect investigations dealing with tobacco insects had its headquarters, as last year, in Clarksville, Tenn., and the work dealt largely with the control of the two species of hornworms of tobacco. An important addition was made to the knowledge of the life history of the hornworms. It was found that the emergence of the moths from the ground in the spring extends over a long period—in fact, until August. It has been supposed that the moths appearing in August were of the second generation, and hence it was argued that large numbers of the first generation of the worms must have escaped destruction by the poisons used. It was thought by planters that it would do little good to attempt to destroy the insects in hibernation, because a large number of worms would escape on young tobacco and in the next generation cause the so-called "August shower of worms." It was found that a comparatively small percentage of the overwintering insects emerge before the end of June—in fact, in 1909 only 4 per cent issued before this time. The last individuals emerging produce a generation of such numbers as to injure tobacco seriously by August 1. During the eleven days from July 30 to August 9, 50 per cent of the hibernating pupæ became adult, and about 8 per cent became adult later. This emphasizes greatly the importance of taking all possible means toward the destruction of the hibernating forms—a move which the planters have hitherto been disinclined to make.

The usual means of controlling the hornworm has been the use of Paris green, but this poison is objectionable on account of injury to the leaf. Arsenate of lead, which does not injure the leaf, kills the insects so slowly that it is objectionable. A form of arsenate of lead has been found, however, which has not this disadvantage, and experiments were conducted with a number of other poisons which promise to be of practical value.

Experimental work against the tobacco flea-beetle was continued, in the way of application of sprays and dust in the plant beds, the dipping of the plants at the time of transplanting, and the application of various poisons both in dust and spray form to plants in the field. The improvement of the seed beds to avoid attack was also studied.

Further investigations on the so-called wireworm of tobacco were carried on at Appomattox, Va. It was found that the insect occurs in great numbers on several wild plants, but the great majority on two species which grow in fallow fields and waste places. It seems obvious that the elimination of these two weeds by cultural process or otherwise would go far toward reducing the injury to tobacco. The greatest damage was found where tobacco was planted on fields in which these weeds had occurred in the greatest numbers. Rotation, therefore, and the keeping down of weeds promise good results.

Further work has been done upon the tobacco thrips and the splitworm in Florida, but it was impossible to conduct this work continuously.

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The work on the cigarette beetle, an important pest in tobacco warehouses, mentioned in the last report, was continued. Consideration has been given to fumigation with different gases at different temperatures, and an effort was made toward devising a new form of package for tobacco that would prevent the entrance of the pest.

SUGAR-CANE AND RICE INSECT INVESTIGATIONS.

The investigations of sugar-cane and rice insects, commencing July 1, 1909, consisted mainly of a preliminary survey of the species affecting these crops, and the beginning of work on the more important enemies that were found. The sugar-cane areas of Louisiana, Texas, and Florida were visited, as well as the rice-growing regions in Louisiana, Texas, and Arkansas. A laboratory was established in Louisiana, and quarters were provided by the Louisiana sugar experiment station, at Audubon Park. The Bureau has been fortunate in enlisting the active cooperation of the Louisiana state experiment stations in this work. This laboratory will be the headquarters for the sugar-cane and rice insect investigations for the South generally, and, as regards Louisiana, will be in direct cooperation with the state officials. The results of the work at this laboratory will apply in a general way to the areas in the entire sugar-cane and rice belts, with the exception of the sugar-cane areas in the Rio Grande Valley in southern Texas and those in southern Florida. Because of the open winters in these districts, by which the insect pests are able to develop continuously, particular consideration must be given to special methods of control.

Work was begun upon the sugar-cane stalk borer, the root beetle, the sugar-cane mealy bug, and the root weevil or maggot of rice. It is estimated that the annual loss through insect pests on sugar plantations in Louisiana reaches $1,500,000; in the Rio Grande Valley the percentage of loss from the sugar-cane stalk-borer is probably as high, and the annual loss from insects injurious to rice in Louisiana, Texas, and Arkansas is estimated to be $966,000. These figures will illustrate the importance of these investigations.

ARGENTINE ANT INVESTIGATIONS.

At the beginning of the fiscal year work on the Argentine ant was undertaken. Mr. Wilmon Newell, formerly secretary of the state crop pest commission of Louisiana, who had done the principal work upon this species in this country, consented to collaborate in this work, and an expert agent was appointed and placed at Baton Rouge, La. The main line of investigation was the relation between the ant and the sugar-cane mealy bug, the control of which seems to be complicated by the ant. At the same time efforts were made toward obtaining information regarding other features of the injury by the ant. The insect is of such importance in so many different ways that its life history must be investigated from every standpoint. Aside from this life-history work, experiments were begun in orange groves in lower Louisiana in the effort to control it by means of traps and the flooding process. This ant has threatened to destroy the orange industry in the parishes of lower Louisiana. In fact, many of the groves have been abandoned. The trap and flooding experiments

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were very encouraging, and it is believed that a practical method of control can be perfected. Attention was also given to the question of preventing the spread of the ant in the United States.

OTHER WORK.

During the year as much attention as possible was paid to the cotton red spider in South Carolina and other States. It appears that this is a pest of more than local importance. Moreover, it is especially important to devise means of reducing injury by the red spider, on account of the invasion by the cotton-boll weevil which will take place before many years have passed. An agent was placed in South Carolina in the fall and in the spring, and experimental work was begun which will be carried through the coming year. The principal hope seems to be for cultural methods, the perfection of which will require some little time.

The investigation of insects injurious to cultivated cactus was practically completed during the year. A few observations and experiments must be repeated on account of the unusual weather conditions of the last year. In several cases good methods of control have been found. Insects interfering with the development of cactus as a farm crop will probably be controlled as a result of this investigation.

INVESTIGATIONS OF INSECTS DAMAGING FORESTS AND FOREST PRODUCTS.

In the course of the Bureau work on forest insects, Dr. A. D. Hopkins in charge, investigations of special problems have been carried on by experts and agents in Colorado, Montana, Oregon, West Virginia, Virginia, Maryland, New York, New Jersey, South Dakota, and Ohio. Information has been given to correspondents in nearly all of the States and Territories, and to forest officials in 62 national forests. Cooperation in the inauguration and demonstration of practical control has been carried on with the Forest Service in certain of the national forests of Colorado, Montana, and Oregon, with the Department of the Interior in a national park, on the public domain in Montana, and with private owners of timber in Montana, Washington, and Oregon; also with manufacturers of agricultural implements, machinery, and vehicles in Ohio, Indiana, and Illinois, and with the state entomologist in a forest insect survey of Illinois.

PRINCIPAL DEPREDATIONS.

The principal depredations during the year have been the continued and extensive damage to living timber in the Rocky Mountain and Pacific slope regions by the Black Hills beetle and the mountain pine beetle on the pine, by the Engelmann spruce beetle on the spruce, and by the Douglas fir beetle on the Douglas fir. An enormous amount of choice timber has been killed during the year, and a threatened destruction of the larger trees in whole forests in Montana, Idaho, Washington, California, and Colorado can only be avoided by prompt and radical action by the Government, state officials, and private owners. Damage to the wood of important hardwood timber in the forests east of the Mississippi River has continued practically

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unchecked, and is probably on the increase, owing to the present methods of lumbering and general management of forest land.

PRACTICAL APPLICATIONS AND RESULTS.

While there is evidence that some of the information on practical methods of preventing losses is being utilized to the best advantage to reduce the cost and increase the profits to owners and operators, which will ultimately lead to reduced cost to the consumer and the better protection of the resources, it becomes more and more apparent that, in order to convince the majority of the people who would derive the most benefit that the information is of real practical value to them, they must be shown. They either have not read the publications or asked for information, or they have not appreciated the importance of adhering to the essential details of the recommendations. Therefore, it has been necessary to carry on a certain amount of demonstration work and for the experts to give direct instructions and advice in the field.

This line of educational work carried on during the past four years has shown most gratifying results during the past year, especially in proving that the methods recommended may be easily understood and properly applied by owners of timber, government forest officials, and managers of manufacturing enterprises, and that the desired results can be secured through the proper expenditure of a comparatively small amount of money and energy.

The areas in Colorado in the vicinity of Colorado Springs, Palmer Lake, Idaho Springs, and on the Trinchera estate and Las Animas National Forest, where the control work directed against the Black Hills beetle was completed at various times since 1905, as mentioned in preceding reports, have been examined during the past year, and, as indicated by the failure to find dying or infested trees, the successful control work continues to have its protective influence.

The control work against the Black Hills beetle in the Wet Mountains section of the San Isabel National Forest, Colorado, completed at the close of the fiscal year 1909, was found, upon examination during the present year, to be a complete success, as were also the control operations in and adjacent to the Jefferson National Forest, Montana, which were started in June, 1909, and completed in July of the same year.

The evidence gathered from the results of the investigations and control work relating to these six cases indicates that the proper disposal of a total of some 4,000 trees within the areas during a period of four years at a first cost of about $2,000, or an average of 50 cents per tree, has ended depredations, which, during a preceding period of ten years, had caused an average death rate of more than 7,000 trees per year, or a total of 7,000,000 feet, board measure, having a stumpage value of $14,000.

The work carried on in cooperation with private timber owners and forest officials in northwestern Montana, inaugurated last fall, has yielded most satisfactory results, especially in the fact that the private owners have been made to realize the importance of prompt action to prevent the total destruction of the remaining merchantable timber. This has led to the proper treatment by cutting and barking or otherwise disposing of between 9,000 and 10,000 beetle-infested

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trees by ten or more of the owners. This, it is believed, will be sufficient to control the depredations over an area of more than 100 square miles in which the timber has been dying at an alarming rate during the past ten or fifteen years. It will also have a marked effect toward protecting the timber of the adjacent areas of the national forests in which like depredations have been going on. The Department of the Interior has allotted sufficient money to take the immediate action required to control the depredations in the southwestern section of the recently established Glacier National Park. It is expected that the Forest Service will take the necessary action within the Flathead and Blackfeet National Forests during the coming year to dispose of a sufficient amount of beetle-infested timber, in addition to that disposed of by private owners and the Department of the Interior, to effectually check the depredations throughout the entire area, thus ending the losses of timber which have been progressing in this general region during the past ten years at a death rate of at least 200,000 trees annually.

IMPORTANT NEW WORK.

During the close of the year there has been organized the most extensive cooperative project for the control of barkbeetle depredations that has ever been undertaken in this country. It is designated as the Northeastern Oregon and Western Idaho Project and involves an area of over 13,000 square miles. The object is to undertake the control of the barkbeetle depredations on the living timber of the national forests and adjacent private and other lands through cooperation between the Bureau of Entomology, the Forest Service, and private owners. The plan provides that the experts of the Bureau of Entomology shall make the investigations of the insects, recommend methods of procedure in control work, and give special instructions and advice relating to the essential details, while the Forest Service and timber owners provide the funds required for the actual control operations.

The experts of the Bureau have already determined that the depredations are so extensive within the area and the time so limited before the beetles begin to emerge from the tens of thousands of infested trees to attack the living timber, that it is not practicable to undertake control work against the present (1909–10) infestation. It is believed, however, that the whole area can be sufficiently worked over and enough trees involved in the new (1910–11) infestation located, marked, and disposed of before the 1st of July, 1911, to effectually check, if not control, the depredations—thus preventing the further loss of timber which has been going on during the past five or six years at the estimated rate of nearly a million trees per year.

INVESTIGATIONS OF INSECTS DAMAGING DECIDUOUS FRUIT TREES.

The investigations of insects affecting deciduous fruits and vineyards, under the direction of Mr. A. L. Quaintance, have included the continuation of projects under way during 1909, and beginning with the spring of 1910 some additional lines of work have been taken up.

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THE PEAR THRIPS.

The results of the Bureau's studies and experiments in the control of the very destructive enemy of deciduous fruits in California known as the pear thrips were set forth in the last report. It was found possible to destroy a large percentage of the total thrips in a given orchard by spraying with a tobacco and distillate spray in the spring, before the opening of the blossoms. Excellent results were also obtained in the destruction of the helpless pupæ in the soil by deep plowing and cross plowing in the fall.

In the fall of 1909 special attention was given to demonstrating on a large scale the benefits of plowing in the control of this insect, and in the spring of 1910 spraying operations were carried out in several parts of the infested territory. The Bureau's agents had full charge of several orchards or parts of orchards, and in addition acted in a supervisory manner over the work done by a considerable number of orchardists. In this way a large amount of remedial work was accomplished, and the active interest of many orchardists in Santa Clara, Contra Costa, Solano, Sacramento, and other counties has materially strengthened the Bureau's work. Thus, in the territory adjacent to Walnut Creek there were sprayed about 220 acres of pears, 100 acres of prunes, and 30 acres of cherries; in the Suisun territory 200 acres of pears, 190 acres of cherries, and 60 acres of prunes; and in the Courtland district 200 acres of pears and 20 acres of cherries; a total in the district to the north of San Francisco of 620 acres of pears, 160 acres of prunes, and 240 acres of cherries.

In the Santa Clara Valley the Bureau's work proper included thorough plowing of about 100 acres and the spraying of about 70 acres of orchard. There were plowed, however, under the advice of the Bureau, about 1,650 acres, and in a similar manner 540 acres of orchard were sprayed. This work on the whole has yielded about as successful results as were obtained the year previous. However, the benefits have been somewhat obscured on account of the serious injury to the prune crop by late spring frost. There is, unfortunately, often a tendency on the part of orchardists to attribute to any injurious insects that may be present the losses resulting from unfavorable weather conditions. It is proposed to take the yield of fruit from sprayed and unsprayed blocks in the orchards under treatment and thus secure definite figures as to the benefits of the work which may be expressed in dollars and cents.

Along with the demonstration and experimental field work, a considerable number of other sprays have been tested as they were sent in by persons believing them to be of value or which have been made according to formulas suggested. None of these, however, has proven equal to the tobacco and distillate oil spray mentioned, and this has become the main reliance. Attention has also been given to obtaining additional information on various points in the life history of the insect, especially in orchards, as to its migration and ground habits, and its distribution in different types of soil. It seems possible that in the deeper alluvial soils, as in the Courtland district, the value of thorough plowing will be materially lessened for the reason that the larvæ are able to penetrate to a considerable depth and below the reach of plows. Our knowledge of the insect, however, is now very

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complete and covers its behavior during the entire year. A complete report on the investigations in the field and laboratory during the past three years is now in course of preparation.

THE CODLING MOTH.

Studies of the codling moth on apple have been continued along lines previously reported. The experiments undertaken in the spring of 1909 in a comparison of the so-called one-spray method, in use in the Northwest, with the practice of spraying generally followed in the East, were concluded and a large amount of data on the subject accumulated, the results of which have already been submitted for publication. In general, it appears that about as good results may be obtained by the one-spray method, in so far as the control of the codling moth and curculio is concerned, as by several treatments applied in the customary way. Notwithstanding these results obtained by the one-spray method, however, the plan is not considered to be of special importance under eastern conditions, for the reason that in this territory it is necessary in nearly all cases to make several applications of a fungicide during the course of the season for the control of fungous diseases, and under these circumstances the addition of an arsenical is, of course, desirable. However, the work points out unmistakably the great importance of much more thorough spraying at the time of the falling of the petals and under a higher pressure than has generally been given heretofore. Further tests of the one-spray method are in progress in Virginia and Michigan, and it is hoped that a final report may be prepared at the close of the present season from the data secured.

The experiments in Missouri and Arkansas orchards in cooperation with the Bureau of Plant Industry of this Department, and mentioned in the last report, comprising a comparison of dusting versus spraying in the control of the codling moth, plum curculio, and fungous diseases, were concluded in the fall of 1909, and report upon the work is in preparation. It appears that the use of dust sprays for the codling moth, curculio, and other apple insects gave results very much inferior to those obtained by the use of liquid sprays, and the dust sprays are notably ineffective in the control of fungous diseases. Thus, in Missouri the yield of merchantable fruit from dusted plats was approximately 3 per cent of the crop as compared with 86 per cent of merchantable fruit on plats sprayed with Bordeaux mixture and arsenate of lead.

Life-history studies of the codling moth in important fruit regions are being continued as heretofore, as in California and Michigan. The studies in progress during the last two seasons in northwestern Pennsylvania have been completed and a report upon the work is now in press. This investigation brought out forcibly the influence of temperature on the extent of, and injury by, the larvæ of the second brood. Thus, during the season of 1907 the proportion of first-brood larvæ to transform into adults was 3 per cent, whereas during the season of 1908 the proportion transforming was 67.7 per cent, a difference due entirely, it is believed, to the widely different seasons which prevailed during these respective years. Similar studies have been made in the Ignacio Valley, in California, in connection with experiments for the control of the codling moth on

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pears. Owing to a lower mean temperature in this valley than in many other fruit-growing regions, the period for the life cycle of the codling moth was greatly lengthened, requiring from sixty to seventy days, as compared with forty-nine to fifty-six, the time required in the East. Spraying experiments for the codling moth in the Ignacio Valley on pears were completed and gave very satisfactory results. Plats of trees receiving two and three applications of arsenate of lead in Bordeaux mixture gave, respectively, 87.68 per cent and 97.10 per cent of sound fruit, whereas on the unsprayed fruit trees only 46.85 per cent of the fruit was free from injury. There was a net gain in favor of spraying of $1.49 per tree. A detailed report on the life history of the insect in the valley and the results of the experiments on pears has been submitted for publication.

Demonstration spraying for the codling moth is being continued during the season of 1910, as heretofore, in cooperation with the Bureau of Plant Industry, mostly in connection with other investigations at the several field laboratories. This work is in progress on pears in several localities in California and on apples in Michigan and Virginia and in nine counties in eastern Kansas in cooperation with the Kansas State Agricultural College. A detailed life-history study of the insect is also being made in the Santa Clara Valley. The demonstration spraying under way in Virginia, Arkansas, Pennsylvania, and Michigan during 1909 was successfully completed and gave uniformly good results. This work has been most heartily appreciated by orchardists in the respective neighborhoods and seems worthy of further extension.

THE GRAPE ROOT-WORM.

The investigations of the grape root-worm, which have been in progress since 1907, were continued over the growing season of 1909 as outlined in the report for that year. This investigation has been very thorough both in the field and in the laboratory, and entirely practical and economical measures have been fully demonstrated. The work was therefore practically concluded in the fall of 1909 and a full report has been submitted for publication.

MISCELLANEOUS GRAPE INSECTS.

In the course of the work on the grape root-worm much information was accumulated on other grape insects. It was found that some of these were of considerable importance, and upon the closing of the grape root-worm studies specific attention has been directed to the so-called rose bug and the grape leafhopper in the Erie grape belt. Studies are also being made on a new insect enemy of the grape, namely the grape bud gnat, which is assuming more and more importance as an enemy of this crop.

ARSENIC ACCUMULATION IN SOILS IN SPRAYED WOODLANDS, ORCHARDS, AND VINEYARDS.

The agitation concerning the danger of injury to orchard, shade, and other trees by excessive spraying with arsenicals, especially with arsenate of lead, led to an examination of soils in sprayed orchards, woodlands, etc., to determine if there were possibly an accumulation

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of arsenic in the soil, and an examination also of trees which might be injured from this cause. A large number of samples was collected during the summer of 1909, and these have been examined by the Bureau of Chemistry, in cooperation with which Bureau the work is being done. The examination of these soils has shown the necessity for further studies and an additional series of soil samples will be collected from the same territory as those earlier obtained.

INSECTICIDE INVESTIGATIONS.

Further experiments have been made with lime-sulphur washes, especially when used with various arsenicals. Special attention is being given to determine the effects of a combined lime-sulphur and arsenical spray on peach foliage, including the various brands of arsenate of lead and other poisons, such as arsenic sulphids, arsenate of iron, zinc arsenate, etc. In California much attention has been given to the preparation of various sprays, especially emulsions of crude oil and distillate, in the course of experiments against the European pear scale and the European fruit Lecanium, or, as it is better known, the brown apricot scale.

DEMONSTRATION SPRAYING FOR THE PLUM CURCULIO.

The plum curculio in the South is a veritable scourge to the peach growers, every year greatly curtailing the crop, its punctures in the fruit, moreover, forming a nidus for brown-rot spores, greatly favoring infection from this serious fruit disease. So critical had become the situation due to the losses from these two troubles—the curculio and the brown rot—that the assistance of the Department was asked through the Georgia Fruit Growers' Exchange, and also by numerous large commercial orchardists. In cooperation with the Bureau of Plant Industry, demonstration spraying on a large scale was begun in different parts of Georgia, using arsenate of lead and self-boiled lime-sulphur mixture as a combined treatment for the curculio and brown rot and the scab. The scheme of treatment requires three applications in all, which practice it had previously been determined would effect the control of the several troubles. In addition to the work under the direct supervision of the Department a very large number of orchardists, acting under its advice, has adopted the plan of spraying recommended, and the total trees treated during the spring of 1910 aggregated several hundred thousands. This work is conducted on a strictly commercial basis, careful account being kept of the cost of the work, and the benefits will be accurately determined by a comparison of the fruit on sprayed and unsprayed blocks.

CRANBERRY INSECT INVESTIGATIONS.

The studies of cranberry insects in Wisconsin, in cooperation with the university of that State, mentioned in earlier reports, were continued along the lines indicated during the season of 1909, and beginning with the spring of 1910 demonstration spraying has been inaugurated in cooperation with numerous cranberry growers, who bear all costs of the work except for spray materials. An unusually

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complete survey of injurious insects of the cranberry bogs in Wisconsin has been about completed, and a good knowledge of the life history of most of these has been obtained. These studies have been made on the bogs under perfectly natural conditions and will be of the utmost value as a basis for making recommendations for their control. Spraying operations under way in 1909 were carried through the season and the results recorded in a way to show the benefits in dollars and cents. The general absence of the fruit-worm, which had been very destructive the year previous, however, resulted in less marked benefits than previously obtained; nevertheless, the results from spraying showed a considerable improvement over unsprayed plats. This work will be concluded at the close of the present season, and it is planned to extend it to cranberry bogs in other States.

CEREAL AND FORAGE-PLANT INSECT INVESTIGATIONS.

Several new problems have engaged the attention of the cereal and forage insect section of the Bureau, under the charge of Mr. F. M. Webster, and the older investigations have been continued.

THE SO-CALLED "GREEN BUG."

The spring grain-aphis, or so-called "green bug," has continued to claim attention. During the autumn of 1909 it seemed to have reached its usual abundance along the line extending from North Carolina to New Mexico, but the ensuing winter was normally cold and restrained the pest, while in March there was an extraordinarily high temperature which enabled the parasites to develop in the spring, so that the pest was soon overcome by its natural enemies. The reverse of this—that is to say, a warm winter and a cold spring—would have certainly produced an enormous abundance of the insect. This emphasizes more than ever the imperative necessity for continuing government surveillance over the region where this pest first begins its depredations in the spring. This area covers approximately 13 States and Territories, while the territory now known to be occupied by the species, and therefore more or less threatened, covers approximately the whole United States west of about the latitude of the city of Washington, excepting perhaps in extreme western New York and Pennsylvania. At present it seems possible to diagnose the situation by keeping close watch upon the species throughout the area where it first begins its ravages, and by utilizing the records of the Weather Bureau. The studies of the past year emphasize the statement previously made that an outbreak of this pest depends upon temperature conditions beginning in the South, and the extent of its ravages depends wholly upon weather conditions during winter and spring. It seems, therefore, extremely desirable that there should always be a sum available for this particular investigation.

A complete report on this insect and its parasites will be prepared for publication during the fiscal year 1911.

WORK ON THE JOINTWORM.

The investigation of the jointworm has been continued more particularly throughout Ohio, Indiana, and southern Illinois, but the insect has been found injurious for the first time in the wheat in Mis-

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souri. Curiously enough, another problem has entered into the jointworm investigation, which involves sanitary as well as agricultural matters. A mite known as *Pediculoides ventricosus* attacks both the jointworm and its hymenopterous parasites, and by its work upon the parasites prevents them from overcoming the jointworm. The mite remains in the straw up to and during the early summer following the harvest, and, whether this straw goes into the manufacture of mattresses or whether it enters into the domestic economy of the farm, it invariably causes a very annoying skin disorder, recently designated by Doctor Goldberger as *Dermatitis schambergi*. Throughout the Middle West the jointworm is the host of this mite, but the mite has caused equally serious trouble in eastern Pennsylvania, New Jersey, Delaware, Maryland, and Tennessee. Throughout this last territory the host insect is the Angoumois grain moth. In both cases it appears that a revision of certain agricultural methods will become necessary. The farmer throughout the Middle West and in the East draws the unthrashed grain in from the fields, places it in barns, and allows it to remain unthrashed for weeks, and sometimes perhaps even for months. This facilitates the development and increase of the mite, and causes an increased number of cases of dermatitis. In Tennessee the farmers allow the grain to remain in the shock long after it should have been thrashed. This also facilitates the increase of the mite, with the result that when this grain is thrashed the men and teams engaged in the work are attacked and caused great pain and suffering. In all cases, if the wheat is thrashed directly from the field and as soon after harvest as it is in condition for thrashing much of the difficulty will be overcome.

HESSIAN FLY INVESTIGATIONS.

The investigations of the Hessian fly have been continued, and a successful introduction of parasites from Kansas has been made into the wheat section of western Oregon. It now seems quite possible as the result of the investigations of the year that what was supposed to be winter-killed wheat in Oregon has really been the work of the Hessian fly. In recent years farmers have found it impracticable to grow wheat in western Washington and Oregon on this account. The attacks of the Hessian fly in the fall have produced this result, and the successful introduction of eastern parasites should have a beneficial effect.

An unexpected outbreak of the Hessian fly in Tennessee is being investigated in cooperation with the agricultural experiment station of that State.

Up to the present time it has been impossible to secure absolute proof that the Hessian fly will attack grasses, but it has been ascertained during the year that it attacks one or more species of Agropyron both in Kansas and in western Washington. To what extent this phase of the problem will increase in the future it is impossible to predict, but it will have the effect of allowing parasites to breed in grass affected by the Hessian fly and to migrate to wheat fields and attack the host insect there.

THE NEW MEXICO RANGE CATERPILLAR.

The unusual and serious state of affairs caused in northeastern New Mexico by the sudden extraordinary development of the larva

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of a large moth attacking the gramma grass on cattle ranges was referred to in the last report. An expert assistant devoted a large portion of the fiscal year to an investigation of this outbreak, and the results have been published in Part V of Bulletin 85 of the Bureau. The insect has spread from a limited area in northeastern New Mexico into the Panhandle region of Texas and the Cherokee strip of Oklahoma, as well as into adjacent portions of Kansas and Colorado. Owing to the immense territory covered by the insect, and to the topography of the country, some of which is almost inaccessible, applications usually employed for destroying insects are impracticable. Only a very small percentage of the caterpillars are parasitized, and yet, from the present outlook, the introduction of parasitic enemies seems the only remedy.

THE ALFALFA WEEVIL.

The alfalfa weevil, beginning in the region about Salt Lake City, is apparently an introduced European insect. It was first observed in the vicinity of Salt Lake, not far from nurseries importing more or less stock from southern Europe, thus indicating a possibility of its introduction in the packing of stock. At the end of the fiscal year 1910 it was making rapid headway toward the alfalfa fields of Colorado, Wyoming, and Idaho. It constitutes a great menace to alfalfa culture. Studies of the life history of the weevil have been carried on in cooperation with the Utah agricultural experiment station, and experimental work has been done with remedies. The peculiar life history of the insect, however, which lays its eggs during a period of six weeks in the spring, near the base of the plant, renders operations against the larvæ extremely onerous on account of the necessity of frequent repetition. An experiment was made in the introduction of a fungous disease which kills an allied weevil in the Atlantic States, but without success. Possibly in irrigated regions with the proper moisture conditions this disease may be made to take hold.

THE SORGHUM MIDGE.

The sorghum midge, which prevents the sorghum raisers in the far South from securing seed, has been thoroughly investigated, and the results have been published. It now seems as though a large part of the difficulty experienced will be eliminated by the destruction of trash left in the field and of the Johnson grass escaped from cultivation and growing along roadsides and other waste places.

OTHER INVESTIGATIONS.

The other investigations of this branch of the Bureau work have included a study of the wheat strawworm in Kansas and the extreme Northwest, the corn root-aphis, the cowpea curculio, the slender seed-corn ground-beetle, a butterfly larva damaging alfalfa in California, Arizona, and Nevada, a gall fly attacking the seed pods of alfalfa in Arizona, the southern corn leaf-beetle, the southern corn root-worm, wireworms, and a number of other species. An important investigation has also been carried out regarding the exact relations of leaf-hoppers to the cultivation of grains and grasses. It was shown some

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years ago by Prof. Herbert Osborn, of the Ohio State University, that the productiveness of pastures is very greatly reduced by these insects, and it is hoped by this investigation to ascertain facts which will bring about amelioration.

WORK ON INSECTS AFFECTING VEGETABLE CROPS.

Work against insects affecting vegetable crops has been carried on, as during the last two years, in different parts of the country. The work has been both demonstrational and investigational. As pointed out in the report for 1908, although the insects occurring in these different regions are frequently identical, their habits and life histories differ on account of the difference in climate, and require either different remedies or modifications of the same remedy. The work has been carried on as heretofore under the direction of Dr. F. H. Chittenden. It is estimated that the annual loss in a number of the most important truck-growing regions of the country from insect damage is 20 per cent of the crop, and that the preventable injury is about 15 per cent, thus indicating the value of the most up-to-date knowledge in this direction.

INVESTIGATIONS IN TIDEWATER VIRGINIA.

Investigations reported upon in the last annual report, in cooperation with the Virginia truck experiment station, the Virginia department of agriculture and immigration, and with associations of truck growers of Norfolk, Va., and vicinity, have been continued. Much demonstration work was found necessary, but some important investigations have been carried on. It has been found that the pea aphis may be successfully controlled by spraying early in the season with whale-oil soap at the rate of 6 pounds to 50 gallons of water, three or four sprayings being necessary for the best results. Tests were made with different nicotine preparations against this same species. Experiments with a lime-sulphur-arsenate-of-lead mixture for the Colorado potato beetle were found quite effective, destroying fully 95 per cent of the insects by a single application. Experiments have been continued against the striped cucumber beetle, the best results being obtained with a combination of arsenate of lead, 3 pounds, in Bordeaux mixture, 2–5–50, as a spray. The strawberry leaf-roller has also been studied in this locality as well as certain other insects.

STRAWBERRY INSECT INVESTIGATIONS IN NORTH CAROLINA.

Beginning with March, 1910, an agent was stationed at Chadbourn, N. C., to study strawberry insects. In 1908 the strawberry weevil caused the destruction of 50 per cent of the strawberry crop in one locality in North Carolina, the cash loss being $700,000. In 1909 the loss in the immediate vicinity of Chadbourn was estimated at $150,000. Especial attention was given to the life history of the species in the locality mentioned. As a result of the preliminary study which has been given to this species and the tests of remedies thus far, it is the belief that the following four items of farm management will work well in keeping strawberry fields free from weevil attack:

1. Cultivation of a large acreage.

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2. The destruction by burning of all adjacent undergrowth in the late fall or winter, and the removal of all wild food plants and débris in which the insects could find winter quarters.

3. High cultivation to secure a maximum number of buds.

4. Immediate and close cultivation of the beds after picking, to destroy infested buds.

The strawberry leaf-roller and a root-worm were also studied in this locality.

INVESTIGATIONS IN COLORADO.

At the beginning of the fiscal year work on truck-crop insects in Colorado was begun, with headquarters at Rocky Ford. The investigation was taken up in cooperation with the Rocky Ford Chamber of Commerce and the commissioners of Otero County and the Rocky Ford Melon Growers' Association. Work was continued until December 1, 1909, and resumed March 11, and continued to the end of the fiscal year 1910. A preliminary test was made of the trap-crop ladybird method of controlling the melon aphis, early growing crucifers being used as a trap crop. The species was largely controlled by natural enemies, so that slight damage was done.

The yellow bear caterpillar did much damage to sugar beets and to the truck crops of the upper Arkansas Valley. It was decided that the best method of controlling the pest was the cleaning up and burning of the rubbish in fence corners and similar places where the insect hibernates. In the same way the best remedy for the larger beet leaf-beetle, or "alkali bug," was found to consist in destroying heaps of weeds, tufts of grass, and other débris in which the insect passes the winter.

The red spider in its occurrence on celery, beans, and other plants, including shrubs, ornamental bushes, and trees, was readily controlled by the use of a lye-sulphur solution.

Further studies were made of other crop insects in this region.

TRUCK INSECTS IN MISSISSIPPI.

In the summer and fall of 1909 work was begun in the State of Mississippi against truck insects, with headquarters at Starkville. This work is still going on against the pests especially injurious to cabbage, Lima beans, melons, tomatoes, and strawberries.

IN CALIFORNIA.

An especial investigation of insects damaging sugar beets and truck crops has been carried on in this State with headquarters at Compton, and the life histories of the insects concerned have been studied and experimental work instituted.

IN SOUTHERN TEXAS.

The work at Brownsville, mentioned in previous reports, has been continued. The onion thrips, with the melon aphis, appears to be the most serious truck-crop pest of southern Texas, and as to the onion thrips the work so far done indicates that unless remedial measures, such as the changing of the farming methods or the appli-

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cation of poisonous sprays, are undertaken, the cultivation of this important crop must be abandoned. The practice of growing onions by starting them in sets seems to be one of the chief causes of injury by thrips. Some injury may be prevented by dipping sets, before transplanting, in nicotine sulphate at about the same strength as used in spraying. Clean methods of cultivation, including prompt destruction of remnants, and the stimulation of plants by means of fertilizers and irrigation where possible, are among the best forms of farm procedure. In some localities the observance of these methods serves to hold the insect in check; in others it is also necessary to spray.

Reports upon a number of Texas insects belonging to this class have been submitted and accounts will be published.

OTHER INVESTIGATIONS ON TRUCK-CROP INSECTS.

The onion thrips just mentioned is by no means confined to Texas, but occurs also in Colorado, and recent reports of injury have been received from Stark County, Ind. The estimate of loss in the latter locality was $30,000 for 1910 in the vicinity of the town of Knox alone. The same insect also occurs in the vicinity of the District of Columbia, and studies of its habits in this locality have been begun.

WORK ON INSECTS AFFECTING CITRUS FRUITS.

As during the previous year, the work on insects affecting citrus fruits has been carried on under the supervision of Mr. C. L. Marlatt. The principal items have been the continuation of the white-fly investigations, work upon the orange thrips in California, and the completion of the hydrocyanic-acid gas fumigation in California.

WORK ON THE WHITE FLY IN FLORIDA.

With the conclusion of the main features of the life-history studies and fumigation experiments on the white fly, summarized in previous reports, problems connected with insecticides and the mechanics of spraying as adapted to Florida conditions have been made the subject of especial study. The agents of the Bureau, however, have continued the very important experiments leading to natural control by bacteria and fungi, and have cooperated with growers in conducting fumigation on a large scale.

Experimental work and observations during previous years with parasitic fungi have demonstrated that under normal climatic and favorable grove conditions the fungi are capable of effecting in a series of years about one-third of a complete remedy, and that they can be very readily introduced artificially into groves infested with the white fly. The main line of investigation during the past year has been to determine to what extent the natural efficiency can be increased by frequent artificial introductions of spores by spraying at stated periods throughout the summer and early fall. This work has not given encouraging results. The amount of fungus present at the end of the season in no instance was enough greater than that developing under normal conditions in unsprayed surrounding trees to warrant from a practical standpoint the time expended in the

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work. In several instances more fungus developed on unsprayed trees. Observations and experiments have led to the conclusion that losses resulting from the white fly attacks will be greatly reduced if, in the majority of cases, the parasitic fungi are disregarded and the use of direct remedial measures extended as fast as possible.

While no specific bacterial disease of the citrus white fly or spotted-wing white fly has yet been discovered, it became evident very early in the present investigation that mortality among larvæ and pupæ resulting from causes other than those recognized as attacks by insect and known fungus enemies, and from overcrowding, was the most important element of natural control affecting these species. This heretofore unappreciated check effected by nature has been credited to the fungi, greatly enhancing the value of the latter. In several instances the fungi have been credited with controlling the fly in groves in which none of the known fungi was present, or in which they were present in too small numbers to bring about the great reduction in the numbers of flies. This phase of natural control is still under investigation.

Fumigation experiments were conducted only in cooperation with the Tangerine Citrus Association of Tangerine and the growers of Arcadia. In each instance an agent of the Bureau gave assistance in securing the necessary apparatus and chemicals and in the general methods of procedure. The fumigation of over one thousand trees under varying conditions thoroughly demonstrated the value of the method of control in isolated groves, as well as its uselessness in groves closely surrounded by untreated infested groves.

The experimental work of the previous year to determine the cost and effect of various insecticides has been continued, together with an extensive study of the mechanics of spraying as adapted to the peculiar conditions presented by the problem in hand. It has been found that by a careful application of knowledge gained by life-history studies the cost of insecticides can be reduced about two-thirds during late spray; while experiments have shown that their cost can be safely reduced about one-half during the summer months, due to the greater susceptibility of the larvæ and pupæ at this season. The control of the fly by spraying has been undertaken in several groves, consisting of several thousands of trees of all sizes, and data are accumulating to warrant the statement that spraying, when once given an intelligent continued trial, will be found a much more promising method of control than is generally believed.

THE ORANGE THRIPS.

The orange thrips, a serious insect enemy of orange in the southern San Joaquin Valley in California, has been under investigation for about two years, and most gratifying progress has been made in the determination of control measures. Large-scale experiments with various sprays have been continued, and on the whole the pest has proved to be less resistant to the sprays than was found to be true of its near relative, the pear thrips. Two or three applications, however, appear to be necessary, since there is a series of generations occurring during the year. The actual area of orange groves under experiment by the Bureau in 1910 is approximately 30 acres, the growers cooperating in allowing the use of the trees. The destructiveness of

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Two large demonstration pastures in southern Texas, one in Victoria County and one in Calhoun County, were utilized for the purpose of demonstrating the feasibility of reducing the tick infestation to a practically negligible quantity. Cattle were removed from these pastures in the spring and returned in the fall. It was found in both pastures that the cattle were practically free from ticks in the spring, although the cattle which had been pastured elsewhere were heavily infested. In the demonstration pastures a continuous and very profitable gain in weight was made and in the others the cattle were in such condition from tick infestation that very low prices were secured.

Efforts to cause the parasite of the brown dog tick to attack the cattle tick were continued but without definite results, except as to methods of manipulation that will assist in future work. Shipments of the parasites were made to South Africa and Italy for attempted introduction by the government entomologists.

Progress was made in the work on the species of ticks which transmit spotted fever of human beings. An agent traveled through some of the Northwestern States to obtain material to reveal the distribution of the species. This work will result in an exact knowledge of the geography of the disease, or at least the region in which it can spread if once introduced. Following this preliminary work, a camp laboratory was established in the Bitter Root Valley, in Montana, where a very virulent phase of the disease exists. Through this laboratory a study was made of the distribution of the dangerous ticks in the locality. There are many points that need investigation. For instance, the disease occurs commonly on the west side of the valley but rarely on the east side. This phenomenon is probably due to some limitation in the distribution of the ticks. In addition, studies of the life history, habits, and means of control will be conducted and demonstrations will be inaugurated if the investigational work seems to warrant it. This work is in cooperation with the Montana State University and the Montana board of health. Prof. R. A. Cooley, of the university, has become a collaborator of the Bureau, and is directing the work. On account of his extensive study of the problem it is considered that the Bureau is fortunate in being able to perfect this arrangement. One of Professor Cooley's students is stationed at the camp. The Biological Survey of the Department is also cooperating. It has stationed two men in the field to determine the limitations in the range of the various animals which act as hosts for the ticks. The Montana board of health has agreed to place a physician at the camp. The work is therefore organized in a comprehensive way and should yield important results.

In addition to the work in the Bitter Root Valley a large amount of information concerning the distribution of the ticks throughout the Rocky Mountains region was obtained by means of circulars. In this way over 500 lots of ticks were obtained, representing practically as many localities. This will enable the Bureau to map the distribution of the form which is now known to be pathogenic in nature and of others which may later be found to be capable of transmitting diseases.

In addition to the main lines of work indicated, progress has been made in the study of some of the other important ticks. A number

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of experiments with the fowl tick have been conducted. This form is so injurious that it has caused the abandonment of the poultry industry in some places. The work has been carried far enough to result in practical suggestions for control which will be dealt with in a circular soon to be issued.

There is a possibility that destructive ticks may be introduced into this country from Mexico at any time. They might be brought across the boundary on cattle, horses, dogs, or even human beings. In order to determine the actual danger an agent was sent through northern Mexico for a few weeks during the year. The results indicate that precautions against the entrance of new forms should by all means be taken.

WORK ON INSECTS INJURIOUS TO STORED PRODUCTS.

The work on insects injurious to stored products has been continued along similar lines, under the direction of Dr. F. H. Chittenden. Special attention was given to inspection and fumigation, as demonstration work and as experiment, in mills in Kansas, Texas, Oklahoma, Missouri, and Louisiana.

THE POINT OF INFESTATION TO EXPORT FLOUR.

The original source of the trouble which caused requests for this line of investigation was the infestation, chiefly by flour beetles (*Tribolium ferrugineum* and others), of export flour milled in the States mentioned and shipped to Europe and Africa, mainly through the ports of New Orleans and Galveston. During the two years in which this topic has been under constant investigation, in the warmer months which permit of such work, effort has been made to determine the exact point of infestation, which might be at any place—at the mill or between that point and the place where the flour is delivered to the purchaser. While a possibility exists of infestation on car and steamship lines, on wagons used in carting the flour or other cereal from the mills to the port of destination, and at the ports both in this country and abroad, it is now established that in the vast majority of cases the point of primary infestation is the milling establishments themselves. A large number of mills have been investigated in the States mentioned, and while many are maintained in a scrupulously neat and clean manner and are fumigated twice a year, or as often as necessary, still there are many others where carelessness prevails and where fumigation is not regularly performed. In the carelessly kept mills, flour beetles, the Mediterranean flour moth, and various other mill pests accumulate and are carried from the mills on sacks of flour, thus infesting cargoes which reach foreign ports in unsalable condition. Under conditions favorable to their development, in warm weather, some of the insects can develop from egg to adult in five or six weeks.

THE MEDITERRANEAN FLOUR MOTH.

As in the past year, the Mediterranean flour moth has again engaged the largest share of attention. The larva or caterpillar of this species is the greatest pest with which millers have ever had to con-

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tend. It particularly infests the machinery of mills, spinning a web which causes flour to become felted and lumpy, and, in summer weather, this clogs the machinery, necessitating frequent and prolonged "shut-downs" resulting in the loss, in large establishments, of thousands of dollars. The average cash loss due to closing a mill and the cost of treatment by fumigation and cleaning has been estimated at about $500 for each fumigation, excluding the loss to business, while the owners of mills of large capacity who have fumigated for this species claim a loss of $5,000 a year. One prominent miller states that the loss due to stoppage while cleaning is incalculable.

The use of hydrocyanic-acid gas as a means of disinfecting mills, warehouses, elevators, and other inclosures has become nearly universal in the principal milling centers, and especially as a remedy for the flour moth. It possesses many advantages over bisulphid of carbon for the same purpose, the principal ones being that the gas can be generated without the aid of fire as in sulphur fumigation, and that it is noninflammable and nonexplosive when generated according to methods now in practice. Hence its employment in mills where there might otherwise be a conflict with insurance companies.

On account of numerous inquiries during the year (which reached as high as five or six daily at times) for advice in regard to the eradication of the flour moth, it was found necessary, as soon as the required data could be obtained, to publish a comprehensive account of the hydrocyanic-acid gas method of fumigation for the control of this pest. This is published as Circular No. 112 (pp. 1–22). In order to make this publication as complete as possible all of the principal topics which were discussed during the year on this process of fumigation were considered in detail, with the result that to date no questions have been asked since its issuance that are not completely answered in the publication.

RICE MILL INVESTIGATIONS.

By request of several rice millers, some mills in southern Texas and Louisiana were investigated. In the course of these investigations, as well as in others conducted both in the Mississippi Valley region and in the Atlantic district, it has been noticed that hydrocyanic-acid gas has one serious defect, and this has been brought out especially during the year. It has very limited penetrative power when used in fumigating sacks of grain and rice. When used under ordinary diffusion, the fact that the greater portion of both clean and weevily rice is stored in sacks under ventilated sheds or in loosely constructed buildings makes the problem of fumigation entirely different from that of the flour mill or grain elevator. If it could be possible to apply hydrocyanic-acid gas and bisulphid of carbon with pressure, as is used in sulphur fumigation by the Clayton process, this problem might be solved. Otherwise it is probable that under existing conditions we will have to depend upon heat as a remedy. Experiments are being conducted in this direction.

MISCELLANEOUS INVESTIGATIONS.

The export docks of Baltimore, Philadelphia, and New York have been visited and investigations have been made of the local condi-

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tions and the insects present in both import and export flour and other cereals.

Fumigation of mills, grain storehouses, and bakeries have been conducted in the city of Washington with good success and will be continued as opportunity offers, the work extending into some near-by mills in Virginia.

More inquiries were received in regard to methods for the prevention of weevils in corn and other stored cereals in the South than in several years, and much information was given in regard to this topic. Efforts were made to ascertain to what extent cereals, especially corn, are attacked in the field, and it was found that in many cases field attack is the direct result of storing grain in the immediate vicinity of grain fields or of planting near granaries. Some common practices in the Gulf region, such as "pulling" or "snapping" fodder so as to expose corn ears to the ripening and hardening effects of the sun, tend to increase injury by the Angoumois grain moth and the rice weevil and should be discontinued. Early harvesting, prompt threshing, and storage in bulk all conduce largely to the prevention of infestation. For the rest, cleanliness in the depositories, with fumigation, preferably before storage, will destroy the insects which remain.

A branch of this topic which will sooner or later demand attention is as to the effect of "weeviled" grain to stock and to human beings when taken as food. Practically nothing definite has been done in this line, although it has been known for some time that horses are badly affected by "weeviled" grain and by the "dust," chiefly excrement, occurring in infested oats and other cereals. They also refuse to eat food containing large granary insects, such as the meal-worms. Chickens, swine, and cows do not appear to be badly affected by a moderate amount of this material, but doubtless all would suffer from a larger diet of "weeviled" grain.

In all, the principal seaboard mills and terminal elevators exporting grain and other cereal products from the Atlantic coast have been inspected and the insects infesting export and import cereals have been studied. In addition, various blending plants and factories manufacturing cereal products, and storage depositories, have been kept under constant observation.

The use of bisulphid of carbon, while prohibited by fire-insurance underwriters in many cases, is still in use for other insects than the flour moth, which affect stored products, and in some cases its use is practically necessary; for example, for spraying spouts and other portions of machinery where hydrocyanic-acid gas is unable to penetrate a large mass of flour. It is also used to a considerable extent either before or after hydrocyanic-acid-gas fumigation.

Experiments have been made with sulphur fumigation where it was not practicable to use other means of treatment, and these have been found successful.

During the year upward of 100 reports were received from many of the principal milling establishments of the country giving results of the treatment of the mills by hydrocyanic-acid gas fumigation.

An agent of the Bureau, working chiefly in the States of Kansas and Texas during the year, has submitted more exhaustive reports

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on experiments with all of the different methods of fumigation which have been mentioned.

In cooperation with the Bureau of Chemistry, insects injurious to imported dried fruits, and especially Smyrna figs, have been studied. Means for their control have been formulated and the work will be continued.

INSPECTION WORK.

As in previous years, all seeds and plants introduced and distributed by the Division of Foreign Seed and Plant Introduction of the Bureau of Plant Industry, as well as ornamental plants imported by florists in the District of Columbia, have been thoroughly examined. In addition to these, about 2,000 cherry trees, a gift from the city of Tokyo to the Government of the United States, were examined and found to be infested with a number of injurious insects. All of these plants were destroyed. Several insects were collected on plants introduced by the Bureau of Plant Industry, which, if allowed to gain a foothold in Florida or other warm portion of the country, might prove serious enemies to cultivated crops.

In addition to this work carried on at Washington, a somewhat elaborate inspection system for products proceeding from regions in New England inhabited by the gipsy moth and the brown-tail moth has been conducted by the gipsy moth force as indicated in a preceding paragraph.

INSPECTION FOR THE IMPORTED BROWN-TAIL MOTH NESTS.

In the last report the efforts of the Bureau to prevent the importation of brown-tail moth nests upon seedlings shipped from Europe to nurserymen in the United States were described. The extraordinary numbers in which these nests were found upon this imported stock was due probably to the occurrence of the brown-tail moth in certain parts of Europe in most unusual numbers during the summer of 1908. In the summer of 1909 the same conditions existed, and as a result the shipments of nursery stock from portions of Europe in the autumn of 1909 and the winter of 1909–10 again carried many nests. Moreover, upon one shipment of nursery stock from Belgium to Louisiana an egg cluster of the gipsy moth was found. By an especial arrangement, through the kindness of the Secretary of the Treasury, with the custom-houses, and by agreement with the railroads, the Bureau was notified of all cases of plants received, and, as in the previous autumn and winter, secured the inspection of probably every shipment at the point of ultimate destination. Shipments of nursery stock to the number of 291 were found to be infested with nests of the brown-tail moth, and these went to the States of Colorado, Connecticut, Georgia, Illinois, Indiana, Kansas, Louisiana, Michigan, Montana, New Jersey, New York, Ohio, and Virginia. In most of the States inspection was rendered simple by the fact that there were efficient state inspection laws and official inspectors. Notification in such cases from the Bureau was all that was necessary. In other cases where there was no such state service, the inspection was carried on either by employees of the Bureau or by expert collaborators appointed for the purpose.

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THE NECESSITY FOR A NATIONAL QUARANTINE AND INSPECTION LAW.

As pointed out in the last annual report, the United States is practically the only one of the great nations of the world which has not protected itself by law from such accidental importations of pests of this character. During the winter an inspection law, based upon the permit system, was drafted and submitted to Congress after consultation with the legislative committee of the National Nurserymen's Association. Thorough hearings on the bill were held before the Committee on Agriculture of the House, but, probably owing to a disagreement on certain sections between the Nurserymen's Association and the officials of the Bureau, the act was not placed upon the calendar.

The hope is again expressed that a satisfactory bill may be drafted the coming autumn, and that it will receive the sanction of both houses of Congress.

In June, 1910, the Chief of the Bureau visited Holland, France, Belgium, and England, in order to look once more into the conditions of growing nursery stock and into the inspection systems in those countries as well. The French Chamber of Deputies failed to pass the inspection law proposed by the ministry of agriculture during the past season, owing to some doubt as to the question of expense. The director of agriculture of France, however, is certain that arrangements will be made in the very near future for the establishment of the competent service referred to in the last report. In the meantime, however, Belgium has established a service, under the directorship of Doctor Staes, of Ghent, which promises efficient inspection in the future. The officials of the board of agriculture in London state that the exporters of nursery stock in Great Britain are willing to have an inspection service started, and it seems probable that the English Government will move in this direction.

The insect conditions in the regions of the large exporting nurseries of France, in the vicinity of Angers, Orleans, and Ussey, were found to be very favorable during June, 1910. For some unknown reason it was with the utmost difficulty that a lepidopterous larva of any kind could be found in the north of France—not a single brown-tail moth caterpillar or gipsy moth caterpillar could be found in any of these nursery regions. The mayor of Angers, during the winter of 1909–10, put in force the hitherto neglected police measures providing for the destruction of every visible nest of the brown-tail moth during the hibernating season. It is quite possible that the efficiency with which this work was carried out has contributed to the clean condition of the Angers nurseries the present season. It seems impossible that the condition of nursery seedlings imported from France during the coming winter can be at all like those of the two past winters, but governmental and state vigilance should not be relaxed on this account, since there are many other European insect pests which constitute dangers to the United States aside from the brown-tail moth and the gipsy moth.

WORK IN BEE CULTURE.

The work in bee culture has been carried on as before under the direction of Dr. E. F. Phillips.

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WORK ON BEE DISEASES.

The work of the past fiscal year on bee diseases has demonstrated more clearly than before that this is the most important subject before the bee keepers of the country. The study of the bacteria of the two infectious bee diseases has been continued, with especial attention to the amount of heat and chemical disinfection necessary to destroy the causative organisms. The results are of great value in prescribing methods of disinfecting contaminated material. The drug treatments advocated by European writers have been carefully tested, and it has been found that none of the drugs is of any value in treating American foul brood, even aggravating the condition in some cases. A large amount of work has been done in the effort to establish the cause of European foul brood. Repeated efforts to produce the disease by giving colonies of bees the organisms supposed to be the cause, namely *Bacillus alvei* and *Streptococcus apis*, have been uniformly unsuccessful. The results of the work so far carried on show only that the disease can be transmitted by feeding infected material. Other organisms found in diseased individuals are being studied, and new media are being tried. The disease responds to the treatment recommended for American foul brood, but, until the cause is ascertained, little can be done further on the remedial side.

In the last report it was stated that the effort to learn the distribution of bee diseases in the country would be completed by the close of 1909, but it has been found that these diseases are much more widespread than was supposed, and it will take at least one more summer to make the work complete enough for record. Samples of dead brood suspected of disease have been obtained from all parts of the United States, and during the past fiscal year 620 samples were examined, as against 280 the previous year. The data obtained in this study of distribution are utilized mainly in sending a practical circular on the treatment of brood diseases to all the bee keepers in infected districts whose names can be obtained. Every effort is made to inform the bee keepers in the infested territory how to combat the maladies. This information is also available for use by bee keepers who are applying for the passage of state laws for the inspection of apiaries, since it indicates the need of such legislation.

It has been found that the treatment recommended by the Bureau can be carried out successfully, not only with no financial loss, but often with an actual increase in returns if done in time.

STUDIES OF THE STRUCTURE AND DEVELOPMENT OF THE BEE.

Work on the structure and development of the bee, which was announced in the last annual report, was completed during the year in so far as the anatomy of the bee is concerned, and the results were published in a technical bulletin. A large number of errors of former observers have been corrected in this bulletin. Accurate information concerning bee anatomy is necessary in many lines of apicultural investigation, especially in investigating the physiology and behavior of bees, these lines being of importance in practical manipulation.

Work on the development of the egg stage of the bee has been conducted during the past year.

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WORK ON THE BEHAVIOR OF BEES.

Investigations have been carried on during the year as to the means by which bees find their way to flowers, the source and gathering of propolis, the behavior of bees on unprotected combs, and color vision. These studies of behavior under normal and abnormal circumstances are highly important in devising practical manipulations.

EXPERIMENTS WITH BEESWAX.

During the past year some preliminary experiments on the removal of the beeswax usually left in slumgum were conducted. It was found that there is usually a considerable amount of wax lost in the methods of wax extraction now employed, and an effort is being made to make an apparatus which will remove this wax economically. The extraction of all the wax from combs is most important, since, where disease is concerned, there are many combs to be rendered. Complete extraction would add greatly to the profits of large apiaries. Bee keepers in various parts of the country are cooperating with the Bureau in the collection of samples of beeswax produced during the gathering of different kinds of honey, since it is known that beeswax from different sources varies considerably in its physical properties.

MISCELLANEOUS.

An effort has been made to learn what is being done in this country and abroad in regard to education in bee culture.

A new location for the Bureau apiary has been obtained at Chevy Chase, Md., and the number of colonies is being increased to accommodate the needs of experimental work.

UNCLASSIFIED WORK.

As in previous years, a great deal of work has been done in different directions which can not be classified under the main sections.

Especial attention has been paid, as in previous years, to the study of pecan insects, especially in Texas and in Mississippi. In the same way the insects injurious to ornamental plants have received considerable attention throughout the year.

More work has been done than in recent years on the subject of insects injurious to shade trees. The demand for information in regard to insects of this class is constantly increasing. Circular publications have been issued on some of the more important species, but new forms appear occasionally, and insects hitherto considered of no economic importance occasionally develop in enormous numbers and destroy the shade trees in certain cities. During the past year the European leopard moth has done serious damage to the shade trees of Cambridge, Mass., and vicinity, and a new pest from Europe, the elm scolytus, has made its appearance in the vicinity of Boston. So serious has been the damage of these two imported pests and of the imported elm leaf-beetle that the beautiful elm trees of Cambridge have been dying by hundreds. In June, 1910, 1,000 large trees were removed. The Bureau has endeavored to aid in all such cases by giving advice, and where investigations can be made of

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the insects of this class at Washington or at the field laboratories of the Bureau they are carried on incidentally to other work.

The work of the specialists of the Bureau, to which annual reference has been made, in the determination of specimens sent in by state entomologists and other workers in practical entomology has again increased. The interest in the study of insects from the practical point of view has grown enormously in recent years, and Washington, by virtue of its large libraries and large force of entomologists, has become the center for this determination work, which could hardly be done as well elsewhere. Much time is occupied in this work, but not only can this hardly be avoided, but it has a very important bearing upon the practical work of the state entomologists, the teachers of economic entomology, and others engaged in practical work. During the fiscal year more than 26,000 specimens were examined in this way.

The correspondence of the Bureau continues to increase, and, in addition to correspondence by circulars, more than 22,500 letters have been written.

The publications of the Bureau have increased in number, fifty-three new publications having been issued during the fiscal year.

PROPOSED WORK FOR THE FISCAL YEAR 1911.

With the gipsy moth and the brown-tail moth work for the fiscal year 1911, some changes in methods are being considered. Continued effort will be made to reduce the cost of the methods in use along woodland roads, and continued experimentation will be made in the hope of finding some means of caring for woodland regions. An improvement in the method of inspecting products shipped by the railroads from infested regions will be made, and a larger force of permanent inspectors will be established from among the more intelligent of the men at present on the rolls.

With the importation of the parasites of the gipsy moth and the brown-tail moth, the time has arrived to reduce the large bulk of the importations, and in the future to bring over only those species which have not yet been received in sufficient abundance to establish perfect colonies. At the time of this writing an agent is in Europe studying the best methods of bringing this about, and is looking into the question of the autumn life and probable methods of hibernation of some of the species involved. More time will be spent upon the study of the species already introduced, in order to secure a more accurate idea than we have at present of what is to be expected of them in the next few years.

With the cotton boll weevil, investigations along the same lines reported upon for the year 1910 will be continued. The work in the Mississippi Valley continues to be the most important work, but it may be necessary during the coming winter and spring to establish observation stations farther east, on account of the continued eastern spread. Experimental field work, however, will be continued throughout the whole infested area. The work upon tobacco insects, sugar cane insects, and rice insects will be continued as outlined in this report, as well as the studies of the cotton red spider and the cotton root louse in South Carolina and adjoining States.

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With forest insects, the investigations of the past fiscal year will be continued. The demonstration work outlined in this report will be carried on as vigorously as the cooperation of the Forest Service and of private owners will permit.

With deciduous fruit insects, the investigations already outlined will be continued to the close of the season, at which time some of them will be concluded. It will be desirable to continue the work with the pear thrips, although the scope of the operations may be lessened. Further codling moth studies are desirable, especially in the Southeast, as in Georgia, which is a coming apple State, and in the Southwest, as in New Mexico and California. Plum curculio demonstration work will probably be continued and enlarged. A study of fruit-insect parasites is to be begun. The establishment of a laboratory in the New England States for the study of the apple maggot and other fruit pests, which was found impracticable in the spring of 1910, it is hoped may be effected in the spring of 1911.

With cereal and forage-plant insect investigations there will be no great expansion of the investigations, but as much attention as possible will be paid to the Hemileuca caterpillar damaging stock ranges in New Mexico, and to the alfalfa weevil in Utah.

No new work, except in a small way, will be carried on in insects affecting vegetable crops.

With insects affecting citrus fruits, as already pointed out, the investigation with hydrocyanic-acid gas has been completed; the work upon the orange thrips will be continued, and the work on the white fly will be carried on in about the same way as during the past fiscal year. Congress has made an appropriation of $5,000 for the investigation in this and foreign countries to discover natural enemies of the white fly, and, in consequence, an expert agent has been sent to oriental regions, where there is reason to believe that the white fly has its original home, in a search for these natural enemies. This mission will probably occupy the greater part of the fiscal year.

Under the work on insects in their direct relation to the health of man and domestic animals, a new series of investigations has been begun on house fly conditions in relation to the agency of this pest in the spread of typhoid fever and other intestinal diseases. Experimental work with mosquitoes will be carried on in a small way. The investigations of the southern cattle tick are being continued. Much important work on the spotted fever tick is under way, having been begun shortly before the close of the last fiscal year. The presence of spotted fever—which is transmitted in nature only by the tick—interferes with the development of large areas of land in the Northwest. The camp laboratory in the Bitter Root Valley will be continued during a portion of the season, and efforts will be made toward obtaining exact information regarding the distribution of the dangerous ticks throughout the territory in which spotted fever occurs. It is hoped that the information gained will enable the residents of the Bitter Root Valley to undertake a campaign of eradication.

The work on insects injurious to stored products will be carried on along the same lines, the only innovation being the sending of an expert assistant to Smyrna to study the conditions under which Smyrna figs become wormy, in the effort to bring about conditions which will enable importers to bring in and sell wormless figs, meeting the provisions of the pure food law.

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Inspection work will be continued as thoroughly as possible in the absence of a national law, and in the same manner in which it was carried on during the past year.

In apiculture the work in progress will not be completed for several years, and the same investigations, therefore, will be continued.

PLANS FOR WORK RECOMMENDED FOR THE YEAR ENDING JUNE 30, 1912.

It is hoped that it will have appeared from this report and the ones preceding that the Bureau is accomplishing good practical results, and that naturally its opportunities should be increased. The writer has no hesitation, therefore, in view of plans in sight, in asking for an increase to the lump fund appropriation of $54,750. It is proposed to expend $36,000 of this increase in adding to the funds devoted to the investigation of insects injurious to forests. The practical results of this work as displayed in this and the other reports have been noticeable. Until the past year or two the small allotment devoted to this work was sufficient to meet the requirements of the field work, which has been directed toward the determination of the principal insect depredations and practical methods of control. This, however, has been accomplished, and it is desired to render greater service in practical results in demonstration work on a large scale. More experts should be employed, and sufficient means should be given the service to enable it to do its part in the prompt and effective manner required to command the confidence and support that is so essential in securing the effective cooperation of the other branches of the Government service and of private timber owners. Ten thousand dollars of the increase asked for will be devoted to the important problem of the alfalfa weevil, concerning which some information is given in this report. This money should be spent in cooperation with the state authorities of Utah and the other States which will be involved in all probability before the beginning of the fiscal year 1912. With the remainder of the increase recommended, it is proposed to devote $3,000 to the investigation of southern field crops, especially sugar cane and rice, in addition to the sums already allotted to that purpose; to give $3,750 to further increase the facilities of investigations of insects injurious to truck crops, and $2,000 increase to the investigations being carried on against bee diseases.

It is also respectfully urged that the salary of the Chief of the Bureau be increased to $5,000. The importance and scope of the work connected with the Bureau seem such as to justify this increase.

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REPORT OF THE CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., October 4, 1910.

SIR: I have the honor to transmit herewith a report on the work of the Biological Survey for the fiscal year ended June 30, 1910, with outline of work for 1911.

Respectfully,

H. W. HENSHAW,
Chief, Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

WORK OF THE BIOLOGICAL SURVEY.

The work of the Biological Survey as laid down by Congress is conducted under three general heads: (1) Investigations of the economic relations of birds and mammals to agriculture; (2) investigations concerning the geographic distribution of animals and plants with reference to the determination of the life and crop belts of the country; (3) supervision of matters relating to game preservation and protection, and importation of foreign birds and other animals.

GROUND SQUIRRELS AND SPOTTED FEVER.

During the year an important investigation was begun, in cooperation with the Bureau of Entomology and the state authorities of Montana, to discover the original source of infection of the so-called spotted fever of Bitterroot Valley, Montana, and other parts of the Rocky Mountain region. This fever, which in certain localities is usually fatal, is believed to be disseminated by ticks which are harbored on ground squirrels and perhaps other mammals indigenous to the region. A first and very important step in any attempt to eradicate the disease is to discover the particular mammal or mammals which act as carriers. Two assistants of the Survey spent several months in the Bitterroot Valley studying the distribution and habits of its mammals and trapping large numbers so as to secure for study by entomologists the ticks infesting them. Individuals showing signs of disease were turned over to experts for examination with a view to the discovery of the organism causing the fever. It is believed that by these cooperative efforts definite progress has been made in the study of the etiology of this disease.

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Should the ground squirrels prove to be the chief host for the tick which disseminates the dreaded fever, it is believed their extermination within the limits of the valley can be accomplished without undue expenditure of labor and money.

CALIFORNIA GROUND SQUIRREL.

Recent investigations by the Public Health and Marine-Hospital Service in California show that the infection of ground squirrels with plague is more widespread in the State than was at first supposed, and infected squirrels have been found in ten counties: Alameda, Contra Costa, Merced, Monterey, San Benito, San Joaquin, San Luis Obispo, Santa Clara, Santa Cruz, and Stanislaus. As yet, however, very few of the several thousand ground squirrels examined from those sections show infection, the total number up to June 30, 1910, being 381. The infection, therefore, while somewhat widespread, is by no means general, and it is believed that a well-organized campaign of destruction in the counties where infected rodents have been found will go far toward eliminating the danger of the plague's becoming endemic generally among the rodents of California and spreading to other States.

When poisoning operations must be conducted on the large scale necessary in the case of an animal so numerous and widely distributed as this, cost is a prime factor of the problem. Accordingly during the year careful experiments with poisons have been conducted in several parts of California to determine the cheapest and most effective method of use. Green barley heads and whole barley have been found to be the best baits, and strychnine to be the cheapest and most certain poison, provided a good quality be employed. Unfortunately, some of the strychnine bought by farmers is poor, and hence yields a minimum of effectiveness at a maximum of cost.

The best time for poisoning operations has been found to be during the late summer and fall months before the winter rains begin, not only because the animals will more readily eat poisoned bait at this time of year, but because this is the season for preventing increase, the young appearing as early as March in the southern part of the State.

Hundreds of poisoned squirrels were examined with a view to ascertaining how many young they have. They were found to be very prolific, having from 4 to 11 at a birth, or an average of 6 or 7. This prolificness goes far to explain the quickness with which a locality where a part of the squirrel population is destroyed is repopulated.

DIKE BORERS.

During the year demonstrations of methods of poisoning gophers with strychnine and catching them by means of improved traps were made in California, Arizona, and Nevada by assistants of the Survey. At Banning, Cal., by cooperation with ranchers and fruit growers, these destructive rodents were so reduced in numbers that their depredations in many localities ceased. A report from the engineer in charge of the reclamation project at Fallon, Nev., states that whereas in 1906 over 50 expensive breaks in the canals occurred in consequence of tunneling by gophers, during the past year, as a result of the adop-

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tion of methods of destroying the gophers recommended by the Survey, there has not been a single break.

In some localities, as on the Zuñi Reservation in New Mexico, kangaroo rats also burrow in canal banks and cause breaks. During the year these dike injuries were investigated and recommendations for the destruction of the mammals were made, the adoption of which, it is believed, will prevent further injuries.

PRAIRIE DOGS.

Prairie dogs are confined to the States of the Middle West, where in certain regions they do great damage to the forage grasses and other vegetation. During the year experiments have been undertaken by assistants of the Survey in Arizona, Colorado, Wyoming, Montana, and New Mexico to determine the best and cheapest method of poisoning these animals, especially in summer. In fall and winter, when green food is scarce, it is comparatively easy to destroy large numbers by poisoned grain prepared according to a formula worked out by the Survey. In summer, however, when the animals are most active and most destructive and grass and other green food abounds, it is very difficult to induce them to eat poisoned grain. On account of the varying conditions of the natural food supply, further experiments will be necessary before final recommendations can be made.

SEED-EATING MAMMALS IN RELATION TO FORESTRY.

One of the most serious problems connected with the reforestation of treeless areas within the National Forests is the protection of newly planted seeds and young trees from the attacks of birds, mice, gophers, ground squirrels, rabbits, and other rodents whose depredations collectively continue the year through. This is especially true when the only practicable means of reseeding is by broadcast sowing. In certain areas within the Black Hills National Forest the losses of seed after sowing have amounted during the past year to as much as 50 and even 75 per cent. Accordingly the cooperation of the Survey was requested by the Forest Service in an attempt to devise methods of protecting seeds and saplings from such attacks. Hence two assistants visited the Forests where replanting is being conducted on a large scale to experiment with various protective coatings for seeds and also with traps and poisons. The former proved unsuccessful, but attempts to poison the mice and ground squirrels, the chief culprits, proved very successful. The baits recommended are oatmeal mixed with strychnine and water, and wheat coated with hot tallow mixed with strychnine as a protection against moisture. By distributing the poisoned bait several days in advance of the planting, the loss of seed is reduced to a minimum.

COOPERATION WITH THE PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE.

At the request of the Chief of the Public Health and Marine-Hospital Service Prof. D. E. Lantz furnished several chapters for a report by that Bureau entitled "The rat in its relation to the public health." These chapters are: "Natural history of the rat;" "Natural enemies of the rat;" and "The rat as an economic factor."

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COOPERATION WITH THE BUREAU OF ANIMAL INDUSTRY.

At the request of the Bureau of Animal Industry Professor Lantz was detailed to make an inspection of some of the principal packing houses in Chicago and St. Louis, with a view to the recommendation of measures for the suppression of the rat nuisance within them. In the more modern-built establishments which are intended to be rat proof comparatively little trouble is made by the rodents, but in the case of the older plants, the buildings of which may cover several acres of ground and which were constructed without reference to the invasion of rats, the loss is large. It was ascertained that in some of the plants effective work was already being done with traps, and that a substantial reduction in the number of rodents by this means had been effected. Professor Lantz's recommendations include the rat proofing of all buildings used by the packing companies, so far as this can be done consistently with economy; the constant employment within the buildings of at least one skilled trapper; the use of improved traps and certain particularly attractive baits; the elimination of all possible breeding places of rats within buildings and in contiguous sheds and outbuildings; and the employment of poison out of doors where it can be safely used.

INJURY TO TIMBER BY WOODPECKERS.

Woodpeckers are among our most useful birds, and it is difficult to overestimate the value of their services in the preservation of forests by their destruction of boring and other injurious insects. Three species, however, known as sapsuckers, while eating many insects, more than offset the good they do by boring into the cambium or inner layer of the bark of trees for the sake of the sap which exudes from the wounds. These punctures permit the entrance of moisture, bacteria, and fungi, which cause decay and staining of the wood. When the wounds heal, various distortions of the grain are produced, including more or less open knotty checks. The stains render many woods unsightly and lower their market value, and the checks, frequently numerous and of large size, diminish its workability and strength. The wood of many species is sometimes rendered useless except for fuel. The loss to the timber industry of the United States, due to defects in wood caused by sapsuckers, has been conservatively estimated to be at least $1,250,000 annually. Much pains has been taken to ascertain the principal kinds of trees attacked by these birds and the manner and extent of the injuries inflicted in order to devise protective measures, and a report covering every phase of the subject is now being prepared.

FOOD OF WILD DUCKS.

In many sections of the United States wild fowl, once so abundant, are fast becoming scarce, and the time seems to be rapidly approaching when they will no longer be available either for sport or for food. This state of things is attracting wide attention, and among other remedial measures the possibility of rearing wild ducks and geese in preserves is being earnestly discussed. The question of food supply

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has an important bearing on the problem, and for years the Survey has sought to obtain all the duck stomachs possible for the purpose of accurately determining the exact nature of the food, especially of the more highly valued species. During the past year W. L. McAtee visited Wisconsin, New England, Long Island, the South Atlantic, and the Gulf States, chiefly for the purpose of studying the habits of the waterfowl on their feeding grounds, of collecting and identifying the plants they feed on, and of obtaining stomachs for examination. As a result a large amount of information was gathered and more than 700 stomachs were obtained on the trip or were subsequently sent in by sportsmen. This number increases the total on hand to approximately 3,500, the examination of which will materially add to our knowledge of the food of ducks. About 1,200 have already been examined, and a report on the subject is now being prepared for publication.

FLYCATCHERS.

The flycatchers occupy an important economic place because their food consists almost exclusively of insects, many of which are pests to the farmer. While the members of this group are among the most beneficial of birds, it has been claimed that certain species destroy honeybees and hence should be classed as obnoxious. A large number of stomachs of flycatchers, including numerous species, have been obtained and are now being examined to determine the exact status of the group. A report on the subject will be issued.

BIRDS IN RELATION TO THE GYPSY AND BROWN-TAIL MOTHS.

As is well known, the gypsy and brown-tail moths have secured a firm foothold in the New England States and have done great damage to vegetation. Some preliminary work was undertaken in Massachusetts by an assistant of the Survey for the purpose of ascertaining the extent to which birds prey on these moths. In July and August robins appeared to be devouring more gypsy moths than any other birds. Thirty-eight species of birds are now known to feed upon the gypsy moth in some of its stages, and eight species on the brown tail. To some extent birds thus act in checking the spread of these insect pests.

BIRDS IN RELATION TO THE FRUIT INDUSTRY.

During the year the second and final part of a report on the relation of birds to the fruit industry in California was published, and similar investigations were begun in Oregon and Washington, where the raising of fruit has become an important business.

BIOLOGICAL INVESTIGATIONS.

Good progress has been made in both the field and office work of this division. Field investigations of the year included parts of Arizona, Arkansas, California, Illinois, Kentucky, Missouri, Montana, New Mexico, North Dakota, Oregon, Utah, and Wyoming.

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The biological survey of Colorado is practically completed, and the final report is almost ready for publication. The work in New Mexico has been practically finished, and a map and report on its life zones, with annotated lists of the mammals and birds, are being prepared for publication.

The biological survey of Wyoming has been begun with special reference to the life zones and crop areas and to the native mammals and birds and their economic relations. The Wind River and Bighorn valleys, which are covered by reclamation projects, will be taken up first. The extent of the Upper Sonoran life zone in these valleys—the zone of corn and apples—and the crops best adapted to it have been the subjects of inquiry on the part of the Reclamation Service and of prospective settlers. At the request of the Director of the Reclamation Service a provisional report on the life zones and crop adaptations in the Shoshone project has been furnished; but in order to secure more detailed information a careful field survey has been undertaken to determine accurately the boundaries of the crop zones. Field work in the lower Mississippi Valley States has continued, and has resulted in the accumulation of a large amount of information for a report on the faunal and crop areas, with lists of the mammals and birds.

In California only a small amount of work was done, but it resulted in important corrections of the state zone map which is being prepared. A biological survey of both Arizona and Utah is in progress, but considerable yet remains to be done in these areas before final reports can be prepared.

Special effort was made during the year to obtain data for corrections in the general zone map of the United States, and a revised edition is now in progress.

Satisfactory progress has been made in digesting and putting into shape for easy reference the accumulated mass of information on mammals and birds. A great amount of data on the migration and distribution of North American birds has been indexed. This information is constantly used in reports and as a guide in formulating protective regulations for game and other useful birds. Similar work is being done on North American mammals. The mapping of the distribution of both mammals and birds is advancing rapidly, and a large number of the North American species have already been mapped. These maps are invaluable for reference in connection with the study of the useful or harmful species and in planning field work and methods of protection or control.

A report on the wood rats has been prepared for publication. These mammals are of considerable economic importance in parts of the western United States, owing to their injury to crops. The fact that one of these rats in Alameda County, Cal., has been found by the Public Health and Marine-Hospital Service to be infected with plague renders it important that information shall be available on the habits and distribution of these rodents.

Individuals and institutions from all parts of the country continue to send in many birds for identification. The examination of this material enables the Survey to secure much valuable information, and often leads to cooperation in the economic investigations of the Survey.

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GAME PROTECTION.

Problems in the protection of birds and game continue to increase in number and complexity. Restrictions on export and sale, restrictions on the bag limit, introduction of different forms of hunting licenses, and creation of warden systems have multiplied rapidly; state and private preserves have become an important means of conserving and increasing game; experiments in the introduction and propagation of exotic species have made notable advance in popular favor; and through a remarkable spread of interest in the study and preservation of nongame birds numerous measures for protection and increase of these birds occupy public attention.

In direct proportion to this growth have the duties of the game protection section of the Biological Survey increased and broadened. So great are the present demands, in fact, that it is not possible to keep pace with them with the force and funds at present provided. Despite these limitations substantial advance has been made along various lines.

Numerous violations of the federal law regulating interstate commerce in birds and game have been acted on. The 51 bird reservations have been divided into 6 districts to permit more systematic handling; wardens on these reservations are required to report regularly, and several of the reservations have been utilized for studying certain problems relating to the migration or the food habits of birds. Additional data have been gathered concerning hunting licenses. Data have been secured also on several other special topics, more particularly civil-service requirements for game wardens, spring shooting of waterfowl, and legislation for the protection of nongame birds. Work has been pushed on the index of game legislation and nearly all the state laws of the past decade have been indexed.

Details of the work are given herewith under appropriate heads.

IMPORTATIONS.

As required by section 241 of the Federal Criminal Code, careful supervision of the importation of birds and animals has been maintained. Five hundred and nineteen permits have been issued, authorizing the entry of 424,408 birds and 5,644 animals. The birds entered under permit consisted of 346,985 canaries, 7,199 pheasants, 18,931 partridges, and 51,293 miscellaneous birds. In addition to these, 27,333 birds and 1,016 mammals requiring no permit were admitted to entry, making the total entries during the year 361,054 canaries, 30,603 game birds, 60,084 miscellaneous birds, and 6,660 mammals. During the year 12 permits were issued at Honolulu, authorizing the entry of 103 birds and 22 mammals. Of the canaries imported, 7,747 were the popular Norwich canaries, 18 were the long and slender Yorkshire canaries, 24 were the large and heavy Manchester coppies, and 4 were the high-shouldered Belgians. The pheasants included many species imported for game preserve and aviary, 7,785 being English ringnecks. Six cheer pheasants, a species often used in England to cross with other game pheasants, were brought in. Among those imported for ornamental purposes, the rarest were 11 Formosan pheasants and 8 Siamese firebacks. Other interesting importations were 33 of the pure English, 10 true Mongolian, and 4

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Prince of Wales pheasants. European partridges to the number of 18,931 were brought over to stock American game covers. The importation of game birds included many other species, particularly waterfowl, mostly intended for ornamental purposes. Notable among these were 4 ocellated turkeys, 174 Formosan teal, 2 Brazilian teal, and 3 Madagascar ducks.

Continued interest in the Shâma thrush of India as a substitute cage bird for the mockingbird is shown by the importation of 231 of these attractive singers. Other noteworthy nongame birds imported were 19 edelsingers and 460 Lady Gould finches (a large increase of these beautifully colored birds). Two satin bower birds and a number of interesting species collected in Cuba, Mexico, and South America were imported for the New York Zoological Park. A number of the South American species were brought to the United States for the first time.

In July, 1909, information was received that 7,000 eggs had been entered at New York as the eggs of Australian boobies. Investigation disclosed that these eggs, which proved to be tern's eggs from Jamaica, in a semidecomposed condition, were being sold as food in New York restaurants at 30 cents each. Steps were at once taken by the Department of Agriculture and the Treasury Department to prevent further traffic of the kind. Early in August, 1909, a boat from Key West, Fla., returned to that port from Dog Rocks, Bahamas, with a cargo of shellfish and about 1,080 young birds, some salted, others alive. No permit having been obtained, a request for investigation was immediately preferred to the Secretary of the Treasury, who subsequently reported that the disregard of the law was not intentional, and that care would be exercised to prevent a repetition of the offense.

An application for a permit to import two mongooses for Norumbega Park, at Auburndale, Mass., was denied. A mongoose that had been surreptitiously landed at Everett, Wash., August 21, for exhibition at Seattle, was killed.

A determined effort has been made by dealers in cage birds located in Mexico to ship cardinals (redbirds) into this country for sale. Keeping cardinals in captivity is prohibited by the laws of most of the States, and the applicant in each case has been required to secure from the state game warden or commissioner a permit allowing possession before entry has been allowed. In one instance a shipment which had been surreptitiously sent to Chicago was reshipped to Mexico; other shipments were abandoned; and in only one or two cases was the shipper granted the required permit by the state officials.

Owing to pressure of other matters, completion of the card index of importations proved impracticable. The entries were, however, recorded down to December 31, 1908, and an effort will be made to bring them to date during the coming year.

STARLINGS.—Twenty years ago a consignment of starlings was imported into New York and liberated in Central Park. These birds soon became established in New York City, and have slowly spread to other points. Reports have been received showing their extension to Springfield, Mass., on the north and central New Jersey on the south, with one or two records still farther south. In order to ascer-

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tain the exact limits of the range of this bird in the United States, the rate at which it is spreading, and its economic status, an ornithologist was detailed during June to conduct a special investigation. Stomachs have been secured, field notes of abundance and habits made, and other features of the question have been investigated. A full report of the results will be rendered during the coming year.

NATIONAL BIRD RESERVATIONS.

No change has been made during the year in either the number or the boundaries of the national bird reservations. The total number of reservations remains 51, but one of these has been transferred to the Department of Commerce and Labor. Under the act to protect the seal fisheries of Alaska, approved April 21, 1910, the Pribilof Islands in Bering Sea were placed in one reservation in charge of the Secretary of Commerce and Labor. This group includes Walrus and Otter islands, and while the bird reservation on these islands is still maintained it is no longer under the jurisdiction of this Department.

As an aid to administration the various reservations have been divided into six districts, as follows: (1) The Gulf district, including 15 reservations in Florida, Louisiana, and Porto Rico; (2) the Lake district, including 4 reservations in Michigan and North Dakota; (3) the Mountain district, including 11 reservations in the Rocky Mountain States; (4) the Pacific district, including 14 reservations in California, Oregon, and Washington; (5) the Alaska district, including 6 reservations; and (6) the Hawaiian district, including 1 reservation.

Some of the reservations on reservoir sites of the reclamation projects are not yet ready for occupancy, as construction work is still under way. These and several of the other reservations have not yet been provided with wardens. Under the appropriation for maintenance of reservations, which became available July 1, 1909, wardens have been appointed for varying periods of time at fifteen reservations, as follows: Seven in the Gulf district, two in the Lake district, five in the Pacific district, and one in the Mountain district. Several of these wardens are maintained in cooperation with the National Association of Audubon Societies, and on some of the reservations protection has been afforded the birds through light keepers and employees of the Reclamation Service.

As a means of coordinating the work of the wardens and exercising closer supervision, inspection of some of the reservations in the first and second districts was made by members of the Office, and examinations of other reservations in the first and some in the third and fourth districts were made by special inspectors. Experiments in marking birds with bands to determine the course of migration were initiated on the Stump Lake (N. Dak.) and Klamath Lake (Oreg.) reservations, and investigations to determine the homing instinct and the power of birds to find their way back to the breeding grounds, begun by Prof. J. B. Watson in 1907 on the Tortugas (Fla.) reservation, under the direction of the Carnegie Institution, were continued in the spring of 1910. The food habits of birds on this reservation and on Pelican Island also are being investigated.

The protection of birds on reservations has resulted rather unexpectedly in extending protection to certain mammals. On the

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During the present year twenty-four permits for the export of specimens of birds and mammals were issued by the Department. Under these permits there were entered at Seattle two pairs of caribou horns, and two caribou scalps for the Alaska-Yukon-Pacific Exposition, and the skull and hide of one brown bear for the Biological Survey, while under permits issued previously there were entered two moose heads, four live Emperor geese, and eight packages of specimens of birds and mammals. Forty-eight trophies, chiefly moose and brown bears, were entered under shipping licenses from the governor, and one brown bear was entered without license or permit. Nine trophies which were held up by the customs authorities were afterwards released.

INFORMATION CONCERNING GAME.

Much time has been devoted to satisfying the many demands for information concerning game and bird protection and also in securing and systematizing data. Special attention has been given to the abundance and present rate of destruction of big game, particularly deer.

BIG GAME.—Statistics showing the abundance of big game and the effect of protection on various species were gathered. Estimates of the total kill of deer for the season were obtained from the game commissioners of Maine, Vermont, New York, Pennsylvania, Wisconsin, Minnesota, and Louisiana, and from private observers in Michigan, West Virginia, Maryland, Virginia, Georgia, Florida, Alabama, and Mississippi. It was found that the number of deer killed east of the Mississippi was about 57,500. Although this total was practically the same as last year's, yet owing to various local reasons a few States showed important differences. Thus there were increases of 2,000 in Vermont and 3,000 in New York, while Michigan and Wisconsin showed respective decreases of 3,600 and 5,000.

Personal examination was made of conditions in Michigan, Wisconsin, and Minnesota, chiefly to ascertain the extent of the destruction of deer by wolves. The results of this investigation will form the subject of a later report. Several of the deer farms of Iowa and Missouri were visited by a representative of the Biological Survey. From one of these farms the deer had escaped and were rapidly stocking the neighboring land; in one or two instances the captive deer had greatly decreased or had entirely died out.

Progress was made in ascertaining the abundance and distribution of other species of big game. Through the aid of private observers different bands of antelope were located and approximate estimates were obtained of the size of each band. Similar information was secured as regards mountain sheep, various bands of which were located, particularly in southern California.

Through the cooperation of the Forest Service much information has been gained of the areas occupied by deer, antelope, mountain sheep, bears, etc., in the national forests of Arizona, California, and New Mexico.

GAME BIRDS.—Notes on the abundance of game birds and conditions of the season were collated from sportsmen's journals in order

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to secure a general view of the game field. In addition, special investigations were conducted at various ducking centers.

Data were collected concerning the introduction of the Hungarian partridge into the United States, and the material secured formed the basis of an article in the Yearbook for 1909.

No information has been received showing the existence of the quail disease that appeared with such disastrous results a few years ago. The quail raised in 1909 on the state game farm at Sutton, Mass., were nearly a total loss through a malady which, in the opinion of those in charge of the farm, resembled the quail disease; but as no post-mortem examinations were made, it is impossible to state definitely whether this was or was not the disease in question.

INDEX OF GAME LEGISLATION.—A practically complete index has been made of all the game laws of the United States passed during the last decade. Indexes have also been made of the laws of every State west of the Mississippi River and of eight States in the East, viz, Alabama, Florida, Georgia, Illinois, Michigan, Virginia, West Virginia, and Wisconsin.

GAME PROTECTION IN 1909.—The usual résumé of game protection was published as a separate circular (No. 73). As heretofore, special attention was given to the condition of game, a feature that should be made still fuller and more serviceable.

DIRECTORY OF GAME OFFICIALS.—The names and addresses of state game officials and organizations and Audubon societies were published in the form of a circular, as usual. This directory is serviceable to a large number who desire to communicate with officers of state or private organizations.

PHEASANT RAISING.—The material gathered in connection with the investigation of the pheasant industry in the United States was published as Farmers' Bulletin No. 390.

PRIVATE GAME PRESERVES.—The data collected concerning private game preserves in the United States formed the basis of a preliminary report issued as Circular No. 72.

FUR-BEARING ANIMALS.—The preparation of a compilation of laws relating to fur-bearing animals has been nearly completed.

HUNTING ACCIDENTS.—As usual, details were secured of the fatal hunting accidents occurring during the year, which were uncommonly frequent, being about 50 per cent more numerous than last year.

HUNTING-LICENSE STATISTICS.—Data were obtained from game officials of the United States and Canada showing the receipts from hunting licenses during the years 1907 and 1908. The growth in popularity of this means of raising revenue for proper enforcement of the game laws has been marked, and the funds at the disposal of game officials are sometimes very large, especially in California, Illinois, New York, and Wisconsin, where they exceed $100,000 a year.

COOPERATIVE WORK.

In conformity with its regular policy the office has cooperated freely with state game officials and organizations. During the year special assistance was given in California, Illinois, Indiana, Kentucky, Louisiana, Maryland, Michigan, New York, North Dakota,

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Oregon, Tennessee, West Virginia, and Wisconsin. A new law adopted by the legislature of Wisconsin having provided for comprehensive civil-service examinations for deputy wardenships, the civil service commission of the State requested and received the aid of the Biological Survey in preparing and holding oral examinations for deputy game wardens. The counties of the upper peninsula of Michigan were visited by another representative of the office to ascertain the extent of the destruction of deer by wolves and to determine the most successful methods of reducing the number of wolves. As a result of cooperative effort on the part of the state warden and the Biological Survey, duck shooting and grebe hunting in southwest Oregon around the Klamath Lake Reservation was practically abolished, a number of convictions being secured. Cooperation was had with Indiana, Tennessee, Kentucky, and Illinois. Illegal traffic in game in the Kankakee Valley, Indiana, was broken up, and unlawful shipment of game in southern Illinois to East St. Louis by way of Cairo was uncovered and suppressed.

INTERSTATE COMMERCE IN GAME.

The principal center of illegal traffic in game has hitherto been the Middle West, and though under the original Lacey Act much has been done to reduce the extent of such traffic, yet the weakness of both federal and state laws has made it impossible to deal with it effectively. Sections 3 and 4 of the Lacey Act regulating interstate commerce in game were reenacted in modified and much stronger form as sections 242, 243, and 244 of the Criminal Code of the United States passed by Congress March 4, 1909, and before the new law took effect on January 1, 1910, steps were taken to prepare for its enforcement. The strengthening of the federal law and the passage of stronger state laws have developed a new situation, as shown by personal investigations in several important cities and ducking centers in the Ohio and Mississippi valleys. Through the activity of local officials the situation is practically under control in St. Louis, Mo., Cairo, Ill., Louisville, Ky., and New Orleans, La., which have heretofore furnished extensive and numerous operations in the illegal marketing of game.

The first case which arose under the new code involved the shipment from New Orleans to Chicago of 3 barrels marked "fish," but actually containing 70 wild ducks each. Conviction was secured in the federal court at New Orleans, and the two shippers were fined $50 each. A few days before the new code went into effect a case of illegal shipment of game under a false mark occurred in Indiana. A box shipped from Demotte, Ind., on December 28, 1909, containing 63 game birds was seized in Chicago, and, as it had proved extremely difficult to secure convictions merely for false marking of packages under the original Lacey Act, the matter was placed in the hands of the Indiana commissioner of fisheries and game, who not only secured conviction of the shipper, but brought action against four and convicted three persons who had sold the birds for shipment. The total fines and costs in the case amounted to $219.60—more than the maximum fine would have been had the case been prosecuted in the federal court. Three cases of falsely marked packages of game

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from Tennessee were also referred to the game, fish, and forestry warden of that State for action for the reason that procedure in game cases in the Tennessee courts is unusually expeditious. A substantial fine was secured in one of these cases; the other two are still pending. Two cases involving illegal shipment of quail from Hillsboro, Kans., and Louisville, Ky., are now pending in the federal courts.

Besides these new cases, two that were pending at the time of the last report were concluded and the defendants fined. One of these cases involved the shipment of 6,000 quail from Oklahoma City, Okla., the other the shipment of 66 ducks from New Orleans, the packages in both instances being falsely marked.

PLUMAGE.

The new criminal code and several recent state laws provide more stringent regulation than heretofore of the traffic in plumage for millinery purposes, and preparations have been made to enforce these laws in several States. On the Pacific coast the game officials of Oregon and California, after having secured stronger legislation, have taken measures to suppress the sale and possession of aigrettes and plumage of American birds in those States. The matter was brought to the attention also of the convention of state game commissioners held at New Orleans in February, 1910. The state game and fish commissioner of Missouri, after returning from the convention, made preparations to enforce the state plumage law to the full, and designated one of his deputies as "plumage expert," charged with the duty of inspecting and securing satisfactory identification of the goods displayed. The Biological Survey has actively cooperated with these officials at every stage of the proceedings and especially with the commissioner of Missouri, as the attention given the subject in that State is a distinct departure in game protective work. In New York, after an active campaign, a satisfactory law was secured by bird protectionists to replace the former statute relating to plumage. Under this law, which takes effect July 1, 1911, it will be possible for this Department and the state officials in cooperation to furnish adequate protection to herons, egrets, and other American birds that are threatened with extermination because of the great demand for their plumage for hat decoration.

At the Fifth International Ornithological Congress held in Berlin in May, 1910, the subject of protection was given much consideration and resulted in the appointment of an international committee on bird protection composed of representatives of Austria, Bavaria, Belgium, Denmark, France, Germany, Great Britain, Holland, Hungary, Italy, Norway, Russia, Sweden, and the United States. Dr. T. S. Palmer, of this Bureau, and Mr. William Dutcher, president of the National Association of Audubon Societies, were appointed to represent the United States.

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OUTLINE OF WORK FOR 1911.

ECONOMIC ORNITHOLOGY AND MAMMALOGY.

Work on the food habits of birds and mammals will be continued, including the examination of stomachs, tabulation of their contents, and field observations.

Field experiments will be continued to determine the most effective and economical methods of destroying the California ground squirrel, which is so injurious to crops and which is known to be a carrier of the bubonic plague.

Field experiments will be carried on in Washington and Oregon to determine methods of reducing the numbers of the several species of ground squirrels which are so injurious to grain and farm produce.

Experiments in destroying pocket gophers in orchards and farming land with poisons and improved traps will be continued.

Field observations and laboratory experiments will be carried on to devise improved methods for controlling injuries done by field mice, pine mice, and the common mice and rats. The economic relation of the common mole to agriculture will be further studied and a report prepared for publication.

Cooperation with the Forest Service will be continued to devise methods of protecting tree seeds and saplings from the attacks of birds and mammals in attempts to reforest treeless areas within the national forests.

Cooperation with the Reclamation Service in protecting dikes and fills from burrowing mammals will be carried on as in previous years.

The collecting of data relative to deer and elk farming will be continued, and the examination of skunk, mink, and fox farms will be undertaken.

Field work in connection with the relation of woodpeckers to forest insects, and of fruit-eating birds to small cultivated fruits will be continued, as also the investigation in relation to birds and the cotton boll weevil.

The investigation into the food of wild ducks and geese will be completed during the year and a report will be prepared for publication.

Preliminary field work will be taken up concerning the food of shore birds, some of which feed extensively on the young of mosquitoes.

Work on the food of the flycatchers, an important group of birds, which destroy immense numbers of injurious insects, will be completed.

GEOGRAPHIC DISTRIBUTION.

The biological survey of Wyoming will be carried on and it is believed that most of the State can be covered during the coming year. Field work in Montana, Utah, California, and the Mississippi Valley States will be continued. A large-scale zone map of the United States will be published to accompany a report on life and crop zones. Reports on the biological survey of Colorado and New Mexico will be published. A report on the birds of Arkansas will probably be made ready for publication during the year.

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The reports on Colorado and New Mexico will include maps of the life and crop zones, with a discussion of their relations and of the crops best adapted to the several zonal areas. There will also be full lists of the mammals of the State, with notes on their habits, distribution, and economic relations.

GAME PROTECTION.

Much of the work of the coming year will include the continuation of projects already well under way, but in addition to these several new features will receive attention.

For the fuller supervision of importations of foreign birds and mammals into the United States inspectors will be required to examine a larger number of shipments than heretofore, the increase comprising mainly importations of game birds for stocking covers or aviaries.

Investigation of the economic habits of the starling and the present distribution and abundance of this bird in the United States will be continued, and similar investigations will be made of one or two other species imported and liberated at the same time as the starling. The object of this work is to ascertain to what extent these birds have secured a foothold in this country and what results are likely to follow their acclimatization.

Investigation of the millinery trade in the plumage of birds will be continued and extended. Through cooperation with state authorities it is hoped to accomplish much toward the suppression of the use of plumage of American birds for hat decoration.

The knowledge gained by this year's investigation of conditions in the Middle West will form a basis for measures dealing with illegal interstate shipments of game in this region. The Department is now in a position to cooperate effectively with the game officials of those States in which the bulk of the traffic occurs.

Much attention will be given to the question of securing big game to stock federal preserves. Movements are already on foot looking to the placing of antelope in the Wichita game preserve, and it is hoped that arrangements may be made for procuring a stock of deer, elk, and other species of big game for propagation on this and other federal game preserves. Material will be gathered for a history of the movement for federal protection of migratory game birds and a study will be made of the habits of these birds. The results secured will be published in bulletin form.

Warden service will be placed on such of the reservations as are shown to have immediate need of such services. The use of these colonies of birds in the study of problems relating to bird life will be encouraged.

Growing interest is manifested in the propagation of quail, and it is intended to make special investigation of methods of quail raising for publication at a later date. In this connection attention will be given to the general subject of game farming with a view to assisting state authorities to devise a system of regulation which will eliminate all opportunity of marketing wild game under cover of laws permitting the disposing of game raised in confinement.

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REPORT OF THE CHIEF OF THE DIVISION OF ACCOUNTS AND DISBURSEMENTS.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF ACCOUNTS AND DISBURSEMENTS,
Washington, D. C., October 28, 1910.

SIR: I have the honor to submit herewith a report of the work of the Division of Accounts and Disbursements for the fiscal year ended June 30, 1910.

Very respectfully,

A. ZAPPONE,
Chief of Division.

Hon. JAMES WILSON,
Secretary of Agriculture.

CHARACTER OF WORK.

The Division of Accounts and Disbursements audits, adjusts, and pays all accounts and claims against the Department; decides questions involving the expenditure of public funds; prepares advertisements for all work and supplies not contracted for by the General Supply Committee of the Executive Departments; prepares letters of authority; writes, for the signature of the Secretary, all letters to the Treasury Department pertaining to fiscal matters; examines and signs requisitions for the purchase of supplies; issues bills of lading and requests for passenger and freight transportation; prepares the annual estimates of appropriations; prepares annual fiscal reports to Congress, and transacts all other business relating to the financial interests of the Department.

ORGANIZATION.

For the purpose of systematizing its work, the Division is divided into five sections, as follows:

CASHIER'S SECTION.—This section prepares and mails all checks and handles all moneys received and disbursed.

AUDITING SECTION.—This section audits all salary, reimbursement, purchase, telegraph, and express accounts.

BOOKKEEPER'S SECTION.—This section keeps all books pertaining to the fiscal affairs of the Department, indexes all accounts, prepares all requisitions on the Treasury for advances of public funds, compiles for rendition to the accounting officers of the Treasury the quarterly abstracts of expenditures and collections and the account current covering the liability for public funds, and has charge of the correspondence with the accounting officers of the Treasury in the settlement of accounts.

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MISCELLANEOUS SECTION.—This section has charge of the preparation of the several annual reports to Congress and the administrative examination of the accounts of the Forest Service and of the Weather Bureau; also audits all accounts of the Board of Consulting Scientific Experts.

FREIGHT AND TRANSPORTATION SECTION.—This section audits all passenger and freight accounts and prepares and issues all passenger transportation requests and bills of lading covering freight shipments.

WORK OF THE YEAR.

APPROPRIATIONS, EXPENDITURES, ETC.

The total appropriations for the Department for the year ended June 30, 1910, amounted to $15,470,634.16, not including $720,000 and $624,000 appropriated for the several State agricultural experiment stations. Of this sum ($15,470,634.16), $13,794,231.97 was disbursed prior to the close of the year, leaving a balance of $1,676,402.19, nearly all of which is covered by outstanding liabilities. Supplemental accounts for the year 1909 were also paid, amounting to $833,283.44. The unexpended balances for the year 1908, amounting to $442,538.63, were finally covered into the Treasury on June 30, 1910.

There were received, audited, and paid 56,415 accounts, amounting to $10,389,784.78 (not including Forest Service). In payment of these accounts 108,757 checks were drawn on the Treasury at Washington and the subtreasuries at New York and at Chicago.

There were also audited and sent to the Treasury Department for payment 1,473 accounts.

LOST CHECKS.

During the year 37 checks were lost in transit through the mails or by the payees.

REQUISITIONS, LETTERS, AND REQUESTS.

One hundred and four requisitions were drawn on the Treasury, aggregating $10,540,671.75 (this does not include Forest Service).

The number of requisitions issued for supplies was 22,803.

The number of letters of authorization for travel was 6,657.

The number of letters written and received in the ordinary transaction of business was about 87,500.

The number of requests for passenger transportation was 32,418.

The number of requests on the Quartermaster-General for the transportation of government property was 553.

The number of departmental bills of lading issued was 2,626.

NEW BUILDINGS FOR DEPARTMENT.

Of the $1,500,000 appropriated by Congress for new buildings there has been expended $1,499,717.30, leaving a balance on June 30, 1910, of $282.70. This balance was covered into the Treasury to the credit of the "Surplus Fund" on that date upon the recommendation of the Building Committee, there being no outstanding liabilities against the appropriation.

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TEMPORARY SPECIAL DISBURSING AGENTS.

Thirty-five temporary special disbursing agents and nine district fiscal agents were active during the year, and the sum of $4,867,427.15 from the appropriations of the Department was advanced to them, requiring the issuance of 264 requisitions upon the Treasury. The total number of temporary special disbursing agents and district fiscal agents shown includes 22 and 9, respectively, for Forest Service, to whom $4,736,079.81 was advanced, requiring 190 requisitions upon the Treasury. All accounts of temporary special disbursing agents of the Department were given an administrative examination in this Division before being forwarded to the Treasury Department for final audit and settlement.

MILEAGE BOOKS.

During the fiscal year 525 mileage books were purchased for official use by employees of this Department, at a cost of $20,096. Rebates on these books, amounting to $3,216.30, were deposited in the Treasury to the credit of the appropriations.

COMBINED ACCOUNTS.

There were 4,828 combined accounts handled during the fiscal year 1910, and it is estimated that the preparation of at least 24,140 checks was thereby avoided, to say nothing of the saving in clerical labor.

APPROPRIATIONS, DISBURSEMENTS, AND UNEXPENDED BALANCES FOR THE FISCAL YEAR 1910.

The table following shows for the fiscal year the amounts appropriated, disbursed, and unexpended:

Appropriations, disbursements, and unexpended balances for the fiscal year 1910.

Object.	Subappropriations.	Transfer of funds.[a]	Total amount appropriated.	Amount disbursed.	Balance of appropriation on hand.
Salaries, Department of Agriculture (not including Forest Service and Weather Bureau)			$1,066,360.00	$1,042,656.04	$23,703.96
Officers and clerks	$1,058,760			1,035,357.00	23,403.00
Extra labor	7,600			7,299.04	300.96
Contingent expenses, Department of Agriculture			80,000.00	70,360.29	9,639.71
Library, Department of Agriculture			16,500.00	11,915.02	4,584.98
Paper tests, 1910			10,000.00	9,829.16	170.84
Allotted to Bureau of Plant Industry	5,000	$439.25		439.25	
Allotted to Forest Service	5,000	9,560.75		9,389.91	170.84
Buildings, Department of Agriculture ($1,500,000), balance available July 1, 1909			1,251.10	968.40	282.70
Paper tests ($10,000), balance available July 1, 1909			2,527.48	2,437.36	90.12

[a] And not to exceed 10 per centum of the foregoing amounts for the miscellaneous expenses of the work of any bureau, division, or office herein provided for shall be available interchangeably for expenditure on the objects included within the general expenses of such bureau, division, or office, but no more than 10 per centum shall be added to any one item of appropriation except in cases of extraordinary emergency, and then only upon the written order of the Secretary of Agriculture.

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Appropriations, disbursements, and unexpended balances for the fiscal year 1910—Cont'd.

Object.	Subappropriations.	Transfer of funds.	Total amount appropriated.	Amount disbursed.	Balance of appropriation on hand.
BUREAU OF ANIMAL INDUSTRY.					
General expenses, Bureau of Animal Industry			$1,263,760.00	$1,082,152.75	$181,607.25
Inspection and quarantine	$625,000			564,040.67	60,959.33
Eradicating cattle ticks	250,000			225,605.51	24,394.49
Dairy industry	149,000			103,290.98	45,709.02
Animal husbandry	43,000			26,120.67	16,879.33
Diseases of animals	109,000			92,448.68	16,551.32
Purchase of land for experiment station	25,000			25,000.00	
Administrative expenses	62,760			45,646.24	17,113.76
Cooperative experiments in animal feeding and breeding			50,000.00	40,156.32	9,843.68
Meat inspection, Bureau of Animal Industry (permanent appropriation)			3,000,000.00	2,721,505.48	278,494.52
BUREAU OF PLANT INDUSTRY.					
General expenses, Bureau of Plant Industry, 1909–10 (appropriated $50,000), balance available July 1, 1909			32,633.53	32,498.50	135.03
General expenses, Bureau of Plant Industry, 1910			1,130,796.00	982,228.81	148,567.19
Pathological laboratory	22,470			20,404.97	2,065.03
Fruit diseases	34,700			30,096.96	4,603.04
Forest pathology	17,340	$16,540.00 A		15,481.01	1,058.99
Cotton and truck diseases	13,060			11,948.44	1,111.56
Crop physiology	27,290	26,025.00 CM		24,639.06	1,385.94
Bacteriology and nutrition	25,070			20,212.54	4,857.46
Crop acclimatization	17,990			16,831.74	1,158.26
Drug and other plants	43,420	44,820.00 B		40,507.81	4,312.19
Crop technology	13,030			10,002.93	3,027.07
Cotton standardization	12,250			9,286.77	2,963.23
Grain standardization	52,440			42,904.39	9,535.61
Physical investigations	15,510			13,553.75	1,956.25
Special seeds and plants	11,550			9,251.06	2,298.94
Seed testing laboratories	25,840	26,040.00 Q		24,489.56	1,550.44
Grain investigations	63,910	64,830.00 AR		59,441.35	5,388.65
Tobacco investigations	23,180			19,326.49	3,853.51
Cotton breeding	18,130	16,730.00 B		15,387.83	1,342.17
General plant breeding	14,840			11,173.51	3,666.49
Paper plant investigations	10,000			7,602.31	2,397.69
Alkali and drought resistant plants	17,550			15,886.54	1,663.46
Sugar plant investigations	24,300			21,638.64	2,661.36
Taxonomic and range investigations	18,250			16,906.11	1,343.89
Farm management	133,000	132,270.00 PQ		103,980.13	28,289.87
Farmers' cooperative demonstration work	175,000			157,119.90	17,880.10
Dry-land agriculture	31,760			27,474.91	4,285.09
Western agricultural extension	76,680			68,181.74	8,498.26
Pomological investigations	71,360	72,625.00 CM		59,365.34	13,259.66
Experimental gardens and grounds	19,230	21,030.00 D		20,536.90	493.10
Arlington farm and horticulture	38,470	37,200.00 DP		32,869.19	4,330.81
Florida subtropical garden	5,100			4,058.04	1,041.96
South Texas garden	9,100			8,697.31	402.69
Administrative and miscellaneous	48,976	48,856.00 R		42,991.49	5,864.51
Purchase and distribution of valuable seeds			317,960.00	294,875.53	23,084.47
Congressional seed distribution	262,320			243,913.82	18,406.18
Forage crop investigations	10,000			8,841.92	1,158.08
Foreign seed and plant introduction	45,640			42,119.79	3,520.21
BUREAU OF CHEMISTRY.					
General expenses, Bureau of Chemistry			855,000.00	696,393.12	158,606.88
Deficiency act, February 25, 1910	50,000				
Laboratory, miscellaneous expenses	30,000			21,827.30	8,172.70
Laboratory, transportation	6,300			3,209.57	3,090.43
Laboratory, salaries and rent	76,240			64,494.37	11,745.63

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Appropriations, disbursements, and unexpended balances for the fiscal year 1910—Cont'd.

Object.	Subappropriations.	Transfer of funds.	Total amount appropriated.	Amount disbursed.	Balance of appropriation on hand.
BUREAU OF CHEMISTRY—continued.					
General expenses, Bureau of Chemistry—Continued.					
Laboratory, American food products	$5,000			$4,968.75	$31.25
Food and drugs act, salaries in Washington	200,000	$185,000.00 G		169,700.43	15,299.57
Food and drugs act, salaries out of Washington ($266,460)	226,460	GN		217,562.24	8,897.76
Food and drugs act, miscellaneous expenses ($136,000)	120,000			89,523.13	30,476.87
Deficiency act, miscellaneous expenses	27,000			706.96	26,293.04
Food and drugs act, transportation ($85,000)	81,000			55,045.04	25,954.96
Deficiency act, witness fees	23,000			2,959.33	20,040.67
Allotted to Referee Board:					
Food and drugs act, salaries out of Washington	40,000	55,000.00 N		49,868.75	5,131.25
Food and drugs act, miscellaneous expenses	16,000			15,034.94	965.06
Food and drugs act, transportation	4,000			1,492.31	2,507.69
BUREAU OF SOILS.					
General expenses, Bureau of Soils			$197,360.00	189,755.77	7,604.23
Soil laboratory investigations	48,000	48,500.00 J		48,185.46	314.54
Soil water investigations	5,000	4,500.00 J		3,920.54	579.46
Soil survey	137,360			131,163.12	6,196.88
Administrative expenses	7,000			6,486.65	513.35
BUREAU OF ENTOMOLOGY.					
General expenses, Bureau of Entomology			198,400.00	177,971.47	20,428.53
Deciduous fruit insects	46,600	43,600.00 E		37,843.80	5,756.20
Cereal and forage insects	21,000	22,500.00 E		20,309.54	2,190.46
Southern field crop insects	42,000			37,993.38	4,006.62
Forest insects	12,000	13,500.00 E		12,619.30	880.70
Truck crop and stored product insects	16,250			15,031.28	1,218.72
Bee culture	10,000			9,574.87	425.13
Citrus fruit insects	16,500			14,359.48	2,140.52
Miscellaneous insects	34,050			30,239.82	3,810.18
Preventing spread of moths, Bureau of Entomology			300,000.00	246,361.94	53,638.06
BUREAU OF BIOLOGICAL SURVEY.					
General expenses, Bureau of Biological Survey			74,420.00	63,449.01	10,970.99
Game preservation	9,420			6,804.24	2,615.76
Maintenance of mammal and bird reservations	7,000			5,293.68	1,706.32
Food habits of birds and mammals	25,000			22,029.19	2,970.81
Biological investigations	18,000			16,340.47	1,659.53
Administrative expenses	15,000			12,981.43	2,018.57
DIVISION OF PUBLICATIONS.					
General expenses, Division of Publications [a]			33,000.00	29,622.88	3,377.12
Rent in Washington	5,000			4,583.33	416.67
Labor saving machinery, etc	5,000			4,958.95	41.05
Stationery and materials	11,500	12,500.00 M		11,349.21	1,150.79
Furniture and fixtures	1,000			855.54	144.46
Photographic equipment	5,000			4,659.61	340.39
Gas, electricity, etc	1,500			962.87	537.13
Wagons, horses, etc	1,000	1,075.00 S		987.28	87.72
Miscellaneous expenses	3,000	1,925.00 MS		1,266.09	658.91
BUREAU OF STATISTICS.					
General expenses, Bureau of Statistics			117,060.00	100,440.51	16,619.49
Administrative expenses	25,860	23,360.00 K		18,840.65	4,519.35
Special field agents	56,000			49,051.64	6,948.36
State statistical agents	30,200	32,700.00 K		28,430.29	4,269.71
Special investigations	2,500			1,839.48	660.52
Cost production farm products	2,500			2,278.45	221.55

[a] Congress also appropriated in the sundry civil bill for printing and binding, $460,000.

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Appropriations, disbursements, and unexpended balances for the fiscal year 1910—Cont'd.

Object.	Subappropriations.	Transfer of funds.	Total amount appropriated.	Amount disbursed.	Balance of appropriation on hand.
OFFICE OF EXPERIMENT STATIONS.					
Agricultural experiment stations ($863,800)[a]			$143,800.00	$135,444.65	$8,355.35
Agricultural experiment stations	$34,800			33,310.79	1,489.21
Farmers' institutes	10,000			9,439.89	560.11
Station at Alaska	28,000			26,800.00	1,200.00
Station at Hawaii	28,000			28,000.00	
Station at Porto Rico	28,000			28,000.00	
Station at Island of Guam	15,000			9,893.97	5,106.03
Nutrition investigations			10,000.00	7,995.97	2,004.03
Irrigation investigations			75,000.00	68,375.74	6,624.26
Drainage investigations			81,160.00	70,958.93	10,201.07
OFFICE OF PUBLIC ROADS.					
General expenses, Office of Public Roads			100,000.00	80,186.49	19,813.51
Road management	18,000			16,487.05	1,512.95
Investigating road building and maintenance	34,000			29,336.79	4,663.21
Road material	25,000			19,173.00	5,827.00
Reports of investigations	23,000			15,189.65	7,810.35
Total for main department, exclusive of Weather Bureau and Forest Service			9,156,988.11	8,158,560.05	998,428.06
WEATHER BUREAU.					
Salaries, Weather Bureau			205,310.00	204,560.91	749.09
Contingent expenses, Weather Bureau			25,000.00	22,776.08	2,223.92
General expenses, Weather Bureau			1,277,950.00	1,098,308.95	179,641.05
Station salaries	620,750			615,794.73	4,955.27
Miscellaneous expenses	91,000	$91,500.00 O		71,386.10	20,113.90
Instruments, etc	30,000	31,900.00 LO		26,655.35	5,244.65
Rents and repairs	80,000	83,500.00 IL		63,395.65	20,104.35
Traveling expenses	22,000	20,000.00 L		17,671.20	2,328.80
Telephoning and telegraphing	260,000	269,000.00 HI		179,379.82	89,620.18
Line and cable repairs	4,200	3,800.00 H		2,753.82	1,046.18
Investigations and substations	125,000	112,500.00 IO		78,182.46	34,317.54
Printing office	45,000			43,089.82	1,910.18
Total for Weather Bureau			1,508,260.00	1,325,645.94	182,614.06
FOREST SERVICE.					
Salaries, Department of Agriculture, officers and clerks			60,200.00	59,455.90	744.10
General expenses, Forest Service			3,986,000.00	3,575,394.21	410,605.79
Improvement of the National Forests			600,000.00	537,101.27	62,898.73
National Bison Range (appropriated $43,000), balance available July 1, 1909 (deficiency act, February 25, 1910, $7,700)			50,480.40	47,391.22	3,089.18
Naval stores industry ($10,000), balance available July 1, 1909			1,050.68	1,046.13	4.55
Total for (regular) Forest Service			4,697,731.08	4,220,388.73	477,342.35
Total of all regular and special appropriations for entire Department			15,362,979.19	13,704,594.72	1,658,384.47
Refunds to depositors, excess of deposits			59,689.37	48,966.86	10,722.51
Cooperative work, forest investigations			47,965.60	40,670.39	7,295.21
Grand total			15,470,634.16	13,794,231.97	1,676,402.19

[a] This includes $720,000 for State experiment stations under the regular appropriation, to be paid through the Treasury Department. Congress also appropriated $624,000 as a permanent appropriation for State experiment stations under the Adams bill, to be paid through the Treasury Department. Total to be paid through the Treasury Department for State experiment stations, $1,344,000.

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MONTHLY CHECK STATEMENTS.

The check statements submitted by the Treasury and subtreasuries were compared with the checks issued by this Division, and the amounts verified.

ANNUAL SUPPLIES.

Awards for all ordinary annual supplies for the use of this Department during the fiscal year 1910 were made by the General Supply Committee of the Executive Departments, and it was therefore necessary for the Department of Agriculture to advertise independently for only those supplies of a technical character which are used by this Department exclusively, and which, for that reason, were designedly omitted from the general schedule. The awards made for these technical supplies were, as heretofore, based upon bids received through advertisement in the columns of the daily newspapers in the large cities and special mail notifications to all of the well-known dealers in the wares required, the bids, when received, being submitted to and passed upon by a board of award acting under the instructions and by the authority of the Secretary. Although supplies aggregating an amount less than $50 may, under the act of March 1, 1899, be purchased in the open market, all supplies, as far as practicable, were regularly advertised for either directly by the Department or through the General Supply Committee.

PUBLIC MONEYS RECEIVED FROM VARIOUS SOURCES.

There were received from various sources and deposited in the Treasury to the credit of the proper funds the following sums:

Miscellaneous receipts, sales of condemned property, etc	$10,493.23
Telegraph-line receipts, Weather Bureau	1,710.66
Sales of products, agricultural station, Hawaii	33.40
Sales of products, agricultural station, Porto Rico	1,706.56
Sales of products, agricultural station, Alaska	866.42
Sales of products, agricultural station, Guam	17.41
Total	14,827.68

In this connection it is thought desirable to explain the method pursued in receiving and disposing of the moneys pertaining to the several funds.

The proceeds of "condemned property," "library index cards," and "card index of agricultural literature" prepared by the Office of Experiment Stations are covered into the Treasury to the credit of "Miscellaneous receipts," under section 3618 of the Revised Statutes.

Moneys derived from the sales of products at the insular stations in Hawaii, Porto Rico, Alaska, and Guam are used for the maintenance of those stations.

Up to June 30, 1907, the moneys derived from the sales of "publications" issued by the Weather Bureau were deposited in the Treasury to the credit of the appropriation "General expenses" of that Bureau, under section 227 of the Revised Statutes. Since July 1, 1907, these moneys have been deposited to "Miscellaneous receipts," in accordance with the provision in the act making appropriations for this Department for the fiscal year ending June 30, 1908. (34 Stat. L., 1258.)

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"Seacoast telegraph line receipts" are covered into the Treasury under act of March 3, 1883. (22 Stat. L., 616.)

In acknowledgment of each deposit of funds the Treasurer issues to the depositor a duplicate certificate of deposit. The number of this certificate is entered as part of the transaction, and the certificate is filed in this Division.

These moneys are forwarded to the Division of Accounts and Disbursements from the various Bureaus, Divisions, and Offices of the Department, accompanied by a letter or specially printed form, in duplicate, explaining from whence the money was derived. The duplicate is receipted by the Chief of this Division and returned to the sender. The original is placed in the files of this Division as a voucher. The amount received is entered in a book with a description of the transaction copied from the letter of transmittal. If in the form of cash or postal money order, it is so stated in the entry, and if by check or draft a minute description is given, with name of payor, payee, indorser, name of bank, number and date of check, etc. The law requires that money so received shall be deposited in the Treasury within thirty days after its receipt by a Government officer. The practice in this office is to deposit all sums as soon as practicable after they are received unless of an insignificant amount. The Chief of this Division, having no authority to do otherwise, accepts the statements accompanying sums of money submitted to him, assuming them to be in strict accordance with the facts.

ACCOUNTS FOR THE FISCAL YEAR 1908 FINALLY CLOSED.

As required by section 5, legislative act, approved June 20, 1874 (18 Stat. L., 110–111), the unexpended balances of the appropriations for the year 1908 were finally covered into the Treasury on June 30, 1910, and carried to the surplus fund, as follows:

Amount of unexpended balances for fiscal year 1908 turned into the Treasury.

Object.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Salaries, Department of Agriculture, officers and clerks $969,090			
Salaries, Department of Agriculture, extra labor 7,600	$976,690.00	$947,454.88	$21,635.12
Contingent expenses, Department of Agriculture	47,000.00	7,592.28	7.72
Library, Department of Agriculture	12,500.00	46,435.97	564.03
		12,498.43	1.57
BUREAU OF ANIMAL INDUSTRY.			
General expenses, Bureau of Animal Industry $892,200			
Diseases of domestic animals, Minnesota 5,000			
Animal breeding and feeding 50,000	947,200.00	878,938.39	13,261.61
Meat inspection, Bureau of Animal Industry (permanent appropriation)	3,000,000.00	2,970.01	2,029.99
Eradicating cattle ticks, Bureau of Animal Industry, 1908	125,000.00	49,649.15	350.85
Eradicating cattle ticks, Bureau of Animal Industry, 1907 and 1908 (appropriated $25,000, balance July 1, 1907)	10,811.90	2,725,034.27	274,965.73
		122,444.15	2,555.85
		10,811.90	Exhausted.
BUREAU OF PLANT INDUSTRY.			
General expenses, Bureau of Plant Industry, 1908	10,000.00	9,992.61	7.39
General expenses, Bureau of Plant Industry $573,484.25			
Rent and repairs 11,295.75	584,780.00	572,635.62	848.63
Grain investigations	40,000.00	11,295.75	Exhausted.
Purchase and distribution of valuable seeds (includes $50,000, deficiency act) $252,000		39,862.20	137.80
Foreign seed and plant introduction 36,000	288,000.00	249,864.82	2,135.18
Cotton boll weevil investigations, Bureau of Plant Industry, 1908	110,000.00	35,487.38	512.62
		109,513.44	486.56
BUREAU OF CHEMISTRY.			
Laboratory, Department of Agriculture	650,000.00	611,925.10	38,074.90

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Amount of unexpended balances for fiscal year 1908 turned into the Treasury—Cont'd.

Object.	Amount appropriated.	Amount disbursed.	Amount unexpended.
BUREAU OF SOILS.			
Soil investigations $166,000	$170,000.00	$165,589.19	$410.81
Rent of buildings 4,000		3,486.66	513.34
BUREAU OF ENTOMOLOGY.			
Entomological investigations $103,800	113,800.00	101,416.46	2,383.54
White fly investigations 10,000		9,530.04	469.96
Cotton boll weevil investigations, Bureau of Entomology	40,000.00	38,396.83	1,603.17
Preventing spread of moths, Bureau of Entomology, 1907 and 1908 (appropriated $150,000, balance July 1, 1907)	141,407.27	132,475.59	8,931.68
BUREAU OF BIOLOGICAL SURVEY.			
Biological investigations	44,420.00	44,261.67	158 33
DIVISION OF PUBLICATIONS.			
Publications, Department of Agriculture[a]	35,000.00	34,888.63	111.37
BUREAU OF STATISTICS.			
Collecting agricultural statistics $118,000	122,900.00	117,917.44	82.56
Foreign markets investigations 4,900		4,705.02	194.98
OFFICE OF EXPERIMENT STATIONS.			
Agricultural experiment stations ($827,000)[b] $30,000	107,000.00	28,341.73	1,658.27
Farmers' institutes 5,000		4,931.47	68.53
Station at Alaska 24,000		23,995.29	4.71
Station at Hawaii 24,000		23,994.94	5.06
Station at Porto Rico 24,000		24,000.00	Exhausted.
Nutrition investigations	5,000.00	1,758.98	3,241.02
Irrigation investigations	150,000.00	149,305.43	694.57
OFFICE OF PUBLIC ROADS.			
Public road inquiries $55,660	57,660.00	55,592.98	67.02
Rent and repairs 2,000		1,879.93	120.07
Total for main department, exclusive of Weather Bureau and Forest Service	7,789,169.17	7,410,874.63	378,294.54
WEATHER BUREAU.			
Salaries, Weather Bureau	196,990.00	196,250.16	739.84
Fuel, lights, and repairs, Weather Bureau	10,000.00	9,884.15	115.85
Contingent expenses, Weather Bureau	10,000.00	9,815.34	184.66
Salaries, station employees, Weather Bureau	551,550.00	550,545.99	1,004.01
General expenses, Weather Bureau	645,000.00	593,211.46	51,788.54
Total for Weather Bureau	1,413,540.00	1,359,707.10	53,832.90
FOREST SERVICE.			
General expenses, Forest Service $1,696,800	1,756,800.00	1,702,007.47	1,578.17
Rent (joint resolution, Jan. 7, 1908, increasing rent) 60,000		53,214.36	
Administration, etc., of the national forests, 1908	375,000.00	374,034.44	965.56
Survey and report on Appalachian and White Mountain watersheds, 1907 and 1908 (appropriated $25,000, balance July 1, 1907)	23,403.76	15,845.37	7,558.39
Administration, etc., of the national forests, 1907 and 1908 (appropriated $125,000, balance July 1, 1907)	118,786.79	118,786.29	.50
Total for Forest Service	2,273,990.55	2,263,887.93	10,102.62
Total of all regular appropriations for entire Department.	11,476,699.72	11,034,469.66	442,230.06
SPECIAL APPROPRIATIONS.			
Buildings, Department of Agriculture ($1,500,000): Balance available on July 1, 1909	1,251.10	968.40	282.70
Paper tests	10,000.00	9,974.13	25.87
Grand total of all appropriations available for the Department for the fiscal year 1908	11,487,950.82	11,045,412.19	442,538.63

[a] Congress also appropriated in the sundry civil bill for printing and binding, $460,000.

[b] This includes $720,000 for state experiment stations under the regular appropriation, to be paid through the Treasury Department. Congress also appropriated $432,000 as a permanent appropriation for state experiment stations under the Adams bill, to be paid through the Treasury Department. Total to be paid through the Treasury Department for state experiment stations, $1,152,000.

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BUILDINGS RENTED IN THE DISTRICT OF COLUMBIA.

The following statement shows the buildings under rent in the District of Columbia on June 30, 1910:

Buildings rented in the District of Columbia.

Location of buildings.	For what purpose used.	Annual rental.
Nos. 1224–1226 B street sw.	Bureau of Animal Industry, offices and storage purposes.	$720
Rooms 914 and 915 Munsey Building	Bureau of Animal Industry, offices	420
Rear of 1228 C street sw	Bureau of Animal Industry, stable	144
Atlantic Building	Forest Service, offices	24,805
No. 913 E street nw	Forest Service, carpenter shop	270
No. 215 Thirteenth street sw	Division of Publications, document rooms	5,000
No. 201 Thirteenth street sw	Office of Chief Clerk, offices and laboratories	360
No. 203 Thirteenth street sw	....do	420
No. 205 Thirteenth street sw	....do	420
No. 207 Thirteenth street sw	....do	420
No. 207½ Thirteenth street sw	....do	420
No. 209 Thirteenth street sw	....do	420
No. 224 Twelfth street sw	....do	2,500
Nos. 1304–1306 B street sw	Office of Chief Clerk, offices, laboratories, and storage rooms.	2,500
Nos. 1308–1310 B street sw	....do	360
Nos. 221–223 Linwood place sw	Bureau of Plant Industry, seed building	4,800
No. 206 Fourteenth street sw	Bureau of Chemistry, offices and laboratories	180
No. 208 Fourteenth street sw	....do	120
No. 240 Fourteenth street sw	....do	420
Three apartments in The Fairfax	....do	900
No. 1362 B street sw	....do	1,800
Nos. 200–202 Fourteenth street sw	....do	2,500
Stable, lot 27, square 231	Bureau of Chemistry, storage purposes	96
No. 207 Thirteen-and-a-half street sw	Bureau of Chemistry, offices and storage rooms	300
No. 212 Thirteenth street sw	Bureau of Chemistry, offices and laboratories	660
No. 1358 B street sw	....do	750
Nos. 210–212 Fourteenth street sw	Bureau of Chemistry, shed for machinery	240
No. 228½ Thirteen-and-a-half street sw	Bureau of Chemistry, storing food samples	300
No. 216 Thirteenth street sw	Bureau of Chemistry, laboratories and offices	16,000
No. 237 Fourteenth street sw	Office of Public Roads, offices and laboratories	2,000
No. 1316 B street sw	Office of the Solicitor, offices	1,200
No. 215 Twelfth street sw	Office of Experiment Stations, offices	1,200
Total		72,645

ESTIMATES OF APPROPRIATIONS.

The estimates of appropriations for the year ending June 30, 1911, were prepared in this Division, based upon recommendations made by the Chiefs of the several Bureaus and Divisions, and after receiving the approval of the Secretary were forwarded to the Treasury in accordance with statutory requirements.

APPROPRIATIONS AND ESTIMATES FOR 1911.

Estimates for 1911.

Salaries, Department of Agriculture, Office of the Secretary		$198,770
Officers and clerks	$191,170	
Extra labor	7,600	
WEATHER BUREAU.		
Salaries, Weather Bureau		206,150
Contingent expenses, Weather Bureau		25,000
General expenses, Weather Bureau		1,277,110
Station salaries	619,910	
Miscellaneous expenses	94,000	
Instruments, etc	30,000	
Rents and repairs	82,000	
Traveling expenses	22,000	
Telephoning and telegraphing	265,200	
Line and cable repairs	4,000	
Investigations and subetations	120,000	
Printing office	40,000	

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BUREAU OF ANIMAL INDUSTRY.

Salaries		$115,920
General expenses, Bureau of Animal Industry		1,234,540
Inspection and quarantine	$623,000	
Eradicating cattle ticks	250,000	
Dairy industry	147,600	
Animal husbandry	42,000	
Diseases of animals	108,000	
Experimental farm	12,000	
Administrative expenses	51,940	
Cooperative experiments in animal feeding and breeding		50,000

BUREAU OF PLANT INDUSTRY.

Salaries		$255,270
General expenses, Bureau of Plant Industry		1,133,346
Pathological laboratory	$21,710	
Fruit diseases	34,075	
Forest pathology	16,510	
Cotton and truck diseases	12,960	
Crop physiology	25,015	
Bacteriology and nutrition	23,725	
Crop acclimatization	34,670	
Drug and other plants	42,970	
Crop technology	13,030	
Cotton standardization	11,650	
Grain standardization	51,020	
Physical investigations	15,255	
Special seeds and plants	16,650	
Seed testing laboratories	25,830	
Grain investigations	61,925	
Tobacco investigations	22,330	
General plant breeding	13,700	
Paper plant investigations	8,775	
Alkali and drought resistant plants	17,500	
Sugar plant investigations	23,075	
Taxonomic and range investigations	17,650	
Farm management	130,060	
Farmers' cooperative demonstration work	215,155	
Dry-land agriculture	31,730	
Western agricultural extension	74,380	
Pomological investigations	71,615	
Experimental gardens and grounds	13,540	
Arlington farm and horticulture	34,930	
South Texas garden	9,100	
Administrative and miscellaneous	42,811	
Purchase and distribution of valuable seeds		309,590
Congressional seed distribution	265,710	
Foreign seed and plant introduction	43,880	

FOREST SERVICE.

Salaries, Forest Service		$60,200
Improvement of the National Forests		275,000
General expenses, Forest Service		4,708,500
Fighting forest fires	$145,000	
Maintenance and supplies	260,640	
Forest products	129,420	
National Forest range investigations	11,820	
Silviculture, National Forests	66,640	
Management of forests	108,010	
Market and miscellaneous investigations	115,470	
Absaroka National Forest	20,844	
Alamo National Forest	33,449	
Angeles National Forest	50,644	
Apache National Forest	31,414	
Arapaho National Forest	21,560	

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General expenses, Forest Service—Continued.

Arkansas National Forest	$32,960
Ashley National Forest	19,668
Battlement National Forest	15,700
Beartooth National Forest	17,299
Beaverhead National Forest	31,837
Bighorn National Forest	32,238
Bitterroot National Forest	31,391
Blackfeet National Forest	38,159
Black Hills National Forest	44,746
Boise National Forest	27,925
Bonneville National Forest	22,822
Cabinet National Forest	21,143
Cache National Forest	18,700
California National Forest	26,240
Caribou National Forest	20,200
Carson National Forest	28,971
Cascade National Forest	37,280
Challis National Forest	21,600
Chelan National Forest	42,195
Cheyenne National Forest	28,350
Chiricahua National Forest	21,131
Choctawhatchee National Forest	9,009
Chugach National Forest	17,848
Clearwater National Forest	41,105
Cleveland National Forest	38,783
Cochetopa National Forest	17,704
Coconino National Forest	50,226
Coeur d'Alene National Forest	45,976
Columbia National Forest	23,376
Colville National Forest	22,910
Coronado National Forest	24,212
Crater National Forest	31,369
Crook National Forest	27,712
Custer National Forest	12,847
Datil National Forest	42,903
Deerlodge National Forest	41,208
Deschutes National Forest	30,463
Dixie National Forest	16,600
Eldorado National Forest	11,350
Fillmore National Forest	18,730
Fishlake National Forest	20,800
Flathead National Forest	35,830
Fremont National Forest	29,900
Gallatin National Forest	26,594
Garces National Forest	19,345
Gila National Forest	47,484
Gunnison National Forest	20,586
Hayden National Forest	16,850
Helena National Forest	34,508
Holy Cross National Forest	18,610
Humboldt National Forest	19,026
Idaho National Forest	21,780
Inyo National Forest	29,500
Jefferson National Forest	34,001
Jemez National Forest	31,476
Kaibab National Forest	20,400
Kaniksu National Forest	28,448
Kansas National Forest	8,805
Kern National Forest	27,512
Klamath National Forest	42,000
Kootenai National Forest	30,634
La Sal National Forest	13,890
Lassen National Forest	31,154
Leadville National Forest	29,720
Lemhi National Forest	20,750
Lewis and Clark National Forest	17,426
Lincoln National Forest	20,218

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General expenses, Forest Service—Continued.

Lolo National Forest	$28,952
Madison National Forest	24,745
Malheur National Forest	24,063
Manti National Forest	23,000
Manzano National Forest	14,776
Marquette National Forest	2,405
Medicine Bow National Forest	19,854
Michigan National Forest	3,744
Minnesota National Forest	24,433
Minidoka National Forest	17,800
Missoula National Forest	34,504
Moapa National Forest	3,400
Modoc National Forest	30,890
Mono National Forest	23,725
Monterey National Forest	15,070
Montezuma National Forest	23,440
Nebo National Forest	9,300
Nebraska National Forest	18,250
Nevada National Forest	20,900
Nez Perce National Forest	28,507
Ocala National Forest	5,623
Olympic National Forest	32,925
Oregon National Forest	40,882
Ozark National Forest	26,961
Payette National Forest	20,660
Pecos National Forest	29,489
Pend d'Oreille National Forest	27,162
Pike National Forest	41,280
Plumas National Forest	42,012
Pocatello National Forest	20,246
Powell National Forest	16,500
Prescott National Forest	33,851
Rainier National Forest	36,220
Rio Grande National Forest	26,620
Routt National Forest	22,050
Salmon National Forest	29,825
San Isabel National Forest	18,070
San Juan National Forest	31,458
Santa Barbara National Forest	37,889
Sawtooth National Forest	27,200
Sequoia National Forest	31,512
Sevier National Forest	20,550
Shasta National Forest	38,675
Shoshone National Forest	25,220
Sierra National Forest	49,370
Sioux National Forest	10,919
Siskiyou National Forest	29,561
Sitgreaves National Forest	28,074
Siuslaw National Forest	23,175
Snoqualmie National Forest	30,129
Sopris National Forest	22,058
Stanislaus National Forest	35,788
Sundance National Forest	6,029
Superior National Forest	19,379
Tahoe National Forest	30,886
Targhee National Forest	32,400
Teton National Forest	22,100
Toiyabe National Forest	24,000
Tongass National Forest	8,300
Tonto National Forest	33,111
Trinity National Forest	36,000
Tusayan National Forest	27,214
Uinta National Forest	28,600
Umatilla National Forest	17,200
Umpqua National Forest	36,110

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General expenses, Forest Service—Continued.		
Uncompahgre National Forest	$25,990	
Wallowa National Forest	33,300	
Wasatch National Forest	23,450	
Washington National Forest	31,925	
Weiser National Forest	22,800	
Wenaha National Forest	19,790	
Wenatchee National Forest	32,129	
White River National Forest	19,990	
Whitman National Forest	26,950	
Wichita National Forest	10,650	
Wyoming National Forest	19,700	
Zuñi National Forest	19,741	
BUREAU OF CHEMISTRY.		
Salaries		$79,360
General expenses, Bureau of Chemistry		791,340
Laboratory, miscellaneous expenses	$36,000	
Laboratory, salaries and rent	73,000	
Laboratory, American food products	5,000	
Food and drugs act, salaries in Washington	175,000	
Food and drugs act, salaries out of Washington	287,340	
Food and drugs act, miscellaneous expenses	240,000	
BUREAU OF SOILS.		
Salaries		$37,420
General expenses, Bureau of Soils		193,600
Soil laboratory investigations	$48,000	
Soil water investigations	5,000	
Soil survey	135,160	
Administrative expenses	5,440	
BUREAU OF ENTOMOLOGY.		
Salaries		$29,280
General expenses, Bureau of Entomology		197,900
Deciduous fruit insects	$40,600	
Cereal and forage insects	25,000	
Southern field crop insects	47,000	
Forest insects	14,000	
Truck crop and stored product insects	16,250	
Bee culture	10,000	
Citrus fruit insects	16,500	
Miscellaneous insects	28,550	
Preventing spread of moths, Bureau of Entomology		300,000
BUREAU OF BIOLOGICAL SURVEY.		
Salaries		$15,400
General expenses, Bureau of Biological Survey		71,520
Game preservation	$9,420	
Maintenance of mammal and bird reservations	7,000	
Food habits of birds and mammals	25,000	
Biological investigations	18,000	
Administrative expenses	12,100	
DIVISION OF ACCOUNTS AND DISBURSEMENTS.		
Salaries		$61,490
DIVISION OF PUBLICATIONS.		
Salaries		$172,730
General expenses, Division of Publications		30,000
Rent in Washington	$5,000	
Labor-saving machinery, etc	3,000	
Stationery and materials	11,500	
Furniture and fixtures	1,000	
Photographic equipment	4,000	
Gas, electricity, etc	1,500	
Wagons, horses, etc	1,000	
Miscellaneous expenses	3,000	

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BUREAU OF STATISTICS.

Salaries		$104,700
General expenses, Bureau of Statistics		115,620
Administrative expenses	$24,920	
Special field agents	56,000	
State statistical agents	30,200	
Special investigations	2,000	
Cost production farm products	2,500	

LIBRARY.

Salaries		$19,920
General expenses		15,400

OFFICE OF EXPERIMENT STATIONS.

Salaries		$46,180
Agricultural Experiment Stations		862,400
Agricultural Experiment Stations, to be disbursed by the Treasury Department	$720,000	
Agricultural Experiment Stations	33,400	
Farmers' institutes	10,000	
Station at Alaska	28,000	
Station at Hawaii	28,000	
Station at Porto Rico (including $5,000 for coffee investigations)	28,000	
Station at island of Guam	15,000	
Nutrition investigations		10,000
Irrigation investigations		70,380
Drainage investigations		78,860

OFFICE OF PUBLIC ROADS.

Salaries		$21,260
General expenses, Office of Public Roads		92,980
Road management	$16,000	
Investigating road building and maintenance	43,000	
Road material	23,280	
Administrative expenses	10,700	

MISCELLANEOUS.

Contingent expenses, Department of Agriculture	$100,000
Paper tests	10,000
Grand total	13,377,136
Meat inspection, Bureau of Animal Industry (permanent appropriation)	3,000,000

Appropriated for 1911.

FOREST SERVICE.

Salaries (also included in main caption)		$60,200
Improvement of the national forests		275,000
General expenses, Forest Service		4,672,900
Fighting forest fires	$135,000	
Maintenance and supplies	221,040	
Forest products	129,420	
National Forest Range Investigations	11,820	
Silviculture, National Forests	66,640	
Management of Forests	108,010	
Market and Miscellaneous Investigations	115,470	
Paper Tests	14,000	
Absaroka National Forest	20,844	
Alamo National Forest	33,449	
Angeles National Forest	50,644	
Apache National Forest	31,414	

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General expenses, Forest Service—Continued.

Arapaho National Forest	$21,560
Arkansas National Forest	32,960
Ashley National Forest	19,668
Battlement National Forest	15,700
Beartooth National Forest	17,299
Beaverhead National Forest	31,837
Bighorn National Forest	32,238
Bitterroot National Forest	31,391
Blackfeet National Forest	38,159
Black Hills National Forest	44,746
Boise National Forest	27,925
Bonneville National Forest	22,822
Cabinet National Forest	21,143
Cache National Forest	18,700
California National Forest	26,240
Caribou National Forest	20,200
Carson National Forest	28,971
Cascade National Forest	37,280
Challis National Forest	21,600
Chelan National Forest	42,195
Chiricahua National Forest	21,131
Choctawhatchee National Forest	9,009
Chugach National Forest	17,848
Clearwater National Forest	41,105
Cleveland National Forest	38,783
Cochetopa National Forest	17,704
Coconino National Forest	50,226
Coeur d'Alene National Forest	45,976
Colorado National Forest	19,854
Columbia National Forest	23,376
Colville National Forest	22,910
Coronado National Forest	24,212
Crater National Forest	31,369
Crook National Forest	27,712
Custer National Forest	12,847
Datil National Forest	42,903
Deerlodge National Forest	41,208
Deschutes National Forest	30,463
Dixie National Forest	16,600
Eldorado National Forest	11,350
Fillmore National Forest	18,730
Fishlake National Forest	20,800
Flathead National Forest	35,830
Fremont National Forest	29,900
Gallatin National Forest	26,594
Garces National Forest	19,345
Gila National Forest	47,484
Gunnison National Forest	20,586
Hayden National Forest	16,850
Helena National Forest	34,508
Holy Cross National Forest	18,610
Humboldt National Forest	19,026
Idaho National Forest	21,780
Inyo National Forest	29,500
Jefferson National Forest	34,001
Jemez National Forest	31,476
Kaibab National Forest	20,400
Kaniksu National Forest	28,448
Kansas National Forest	8,805
Kern National Forest	27,512
Klamath National Forest	42,000
Kootenai National Forest	30,634
La Sal National Forest	13,890
Lassen National Forest	31,154
Leadville National Forest	29,720
Lemhi National Forest	20,750

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General expenses, Forest Service—Continued.	
Lewis and Clark National Forest	$17,426
Lincoln National Forest	20,218
Lolo National Forest	28,952
Madison National Forest	24,745
Malheur National Forest	24,063
Manti National Forest	23,000
Manzano National Forest	14,776
Marquette National Forest	2,405
Medicine Bow National Forest	28,350
Michigan National Forest	3,744
Minnesota National Forest	24,433
Minnidoka National Forest	17,800
Missoula National Forest	34,504
Moapa National Forest	3,400
Modoc National Forest	30,890
Mono National Forest	23,725
Monterey National Forest	15,070
Montezuma National Forest	23,440
Nebo National Forest	9,300
Nebraska National Forest	18,250
Nevada National Forest	20,900
Nezperce National Forest	28,507
Ocala National Forest	5,623
Olympic National Forest	32,925
Oregon National Forest	40,882
Ozark National Forest	26,961
Palisade National Forest	15,550
Payette National Forest	20,660
Pecos National Forest	29,489
Pend d'Oreille National Forest	27,162
Pike National Forest	41,280
Plumas National Forest	42,012
Pocatello National Forest	20,246
Powell National Forest	16,500
Prescott National Forest	33,851
Rainier National Forest	36,220
Rio Grande National Forest	26,620
Routt National Forest	22,050
Salmon National Forest	29,825
San Isabel National Forest	18,070
San Juan National Forest	31,458
Santa Barbara National Forest	37,889
Sawtooth National Forest	27,200
Sequoia National Forest	31,512
Sevier National Forest	20,550
Shasta National Forest	38,675
Shoshone National Forest	25,220
Sierra National Forest	49,370
Sioux National Forest	10,919
Siskiyou National Forest	29,561
Sitgreaves National Forest	28,074
Siuslaw National Forest	23,175
Snoqualmie National Forest	30,129
Sopris National Forest	22,058
Stanislaus National Forest	35,788
Sundance National Forest	6,029
Superior National Forest	19,379
Tahoe National Forest	30,886
Targhee National Forest	16,850
Teton National Forest	22,100
Toiyabe National Forest	24,000
Tongass National Forest	8,300
Tonto National Forest	33,111
Trinity National Forest	36,000
Tusayan National Forest	27,214
Uinta National Forest	28,600

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General expenses, Forest Service—Continued.		
Umatilla National Forest	$17,200	
Umpqua National Forest	36,110	
Uncompahgre National Forest	25,990	
Wallowa National Forest	33,300	
Wasatch National Forest	23,450	
Washington National Forest	31,925	
Weiser National Forest	22,800	
Wenaha National Forest	19,790	
Wenatchee National Forest	32,129	
White River National Forest	19,990	
Whitman National Forest	26,950	
Wichita National Forest	10,650	
Wyoming National Forest	19,700	
Zuñi National Forest	19,741	

SPECIAL APPROPRIATION.

Paper tests, 1911 (sundry civil bill, June 25, 1910)	$30,000

OFFICE OF THE SECRETARY.

Salaries, Department of Agriculture (not including Weather Bureau)		$1,267,500
Officers and clerks	$1,259,900	
Extra labor	7,600	
Contingent expenses, Department of Agriculture		100,000
Library, Department of Agriculture		15,400

BUREAU OF ANIMAL INDUSTRY.

General expenses, Bureau of Animal Industry		$1,234,540
Inspection and quarantine	$623,000	
Eradicating cattle ticks	250,000	
Dairy industry	147,600	
Animal husbandry	42,000	
Diseases of animals	108,000	
Experimental farm	12,000	
Administrative expenses	51,940	
Cooperative experiments in animal feeding and breeding		50,000
Meat inspection, Bureau of Animal Industry (permanent appropriation)		3,000,000

BUREAU OF PLANT INDUSTRY.

General expenses, Bureau of Plant Industry, 1910–1911		$10,000
General expenses, Bureau of Plant Industry, 1911		1,183,346
Pathological laboratory	$21,710	
Fruit diseases	34,075	
Forest pathology	16,510	
Cotton and truck diseases	12,960	
Crop physiology	25,015	
Bacteriology and nutrition	23,725	
Crop acclimatization	34,670	
Drug and other plants	42,970	
Crop technology	13,030	
Cotton standardization	36,650	
Grain standardization	51,020	
Physical investigations	15,255	
Special seeds and plants	16,650	
Seed testing laboratories	25,830	
Grain investigations	61,925	
Tobacco investigations	22,330	
General plant breeding	13,700	
Paper plant investigations	8,775	
Alkali and drought resistant plants	17,500	
Sugar plant investigations	23,075	
Taxonomic and range investigations	17,650	
Farm management	130,060	

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General expenses, Bureau of Plant Industry, 1911—Continued.		
Farmers' cooperative demonstration work	$240,155	
Dry land agriculture	31,730	
Western agricultural extension	74,380	
Pomological investigations	71,615	
Experimental gardens and grounds	13,540	
Arlington farm and horticulture	34,930	
South Texas garden	9,100	
Administrative and miscellaneous	42,811	
Purchase and distribution of valuable seeds		$309,590
Congressional seed distribution	265,710	
Foreign seed and plant introduction	43,880	

BUREAU OF CHEMISTRY.

General expenses, Bureau of Chemistry		$816,340
Laboratory, miscellaneous expenses	$36,000	
Laboratory, salaries and rent	73,000	
Laboratory, American food products	5,000	
Food and drugs act, salaries in Washington	175,000	
Food and drugs act, salaries out of Washington ($287,340)	232,340	
Food and drugs act, miscellaneous expenses ($240,000)	220,000	
Allotted to Referee Board:		
Food and drugs act, salaries out of Washington	55,000	
Food and drugs act, miscellaneous expenses	20,000	

BUREAU OF SOILS.

General expenses, Bureau of Soils		$193,600
Soil laboratory investigations	$48,000	
Soil water investigations	5,000	
Soil survey	135,160	
Administrative expenses	5,440	

BUREAU OF ENTOMOLOGY.

General expenses, Bureau of Entomology		$202,900
Deciduous fruit insects	$40,600	
Cereal and forage insects	25,000	
Southern field crop insects	47,000	
Forest insects	14,000	
Truck crop and stored product insects	16,250	
Bee culture	10,000	
Citrus fruit insects	16,500	
White fly investigations	5,000	
Miscellaneous insects	28,550	
Preventing spread of moths, Bureau of Entomology		300,000

BUREAU OF BIOLOGICAL SURVEY.

General expenses, Bureau of Biological Survey		$71,520
Game preservation	$9,420	
Maintenance of mammal and bird reservations	7,000	
Food habits of birds and mammals	25,000	
Biological investigations	18,000	
Administrative expenses	12,100	

DIVISION OF PUBLICATIONS.

General expenses, Division of Publications[a]		$30,000
Rent in Washington	$5,000	
Labor-saving machinery, etc	3,000	
Stationery and materials	11,500	
Furniture and fixtures	1,000	
Photographic equipment	4,000	
Gas, electricity, etc	1,500	
Wagons, horses, etc	1,000	
Miscellaneous expenses	3,000	

[a] Congress also appropriated in the sundry civil bill for printing and binding, $460,000.

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BUREAU OF STATISTICS.

General expenses, Bureau of Statistics		$115,620
Administrative expenses	$24,920	
Special field agents	56,000	
State statistical agents	30,200	
Special investigations	2,000	
Cost production, farm products	2,500	

OFFICE OF EXPERIMENT STATIONS.

Agricultural experiment stations ($862,400)[a]		$142,400
Agricultural experiment stations	$33,400	
Farmers' institutes	10,000	
Station at Alaska	28,000	
Station at Hawaii	28,000	
Station at Porto Rico (including $5,000 for coffee investigations)	28,000	
Station at Island of Guam	15,000	
Nutrition investigations		10,000
Irrigation investigations		70,380
Drainage investigations		78,860

OFFICE OF PUBLIC ROADS.

General expenses, office of public roads		$92,980
Road management	$16,000	
Investigating road building and maintenance	43,000	
Road material	23,280	
Administrative expenses	10,700	
Total for main department, exclusive of Weather Bureau and Forest Service		9,294,976

WEATHER BUREAU.

Salaries, Weather Bureau		$206,150
Contingent expenses, Weather Bureau		25,000
General expenses, Weather Bureau		1,293,610
Station salaries	$620,410	
Miscellaneous expenses	94,000	
Instruments, etc	30,000	
Sand Key Building	15,000	
Rents and repairs	82,500	
Traveling expenses	22,000	
Telephoning and telegraphing	265,700	
Line and cable repairs	4,000	
Investigations and substations	120,000	
Printing office	40,000	
Total for Weather Bureau		1,524,760
Grand total		15,797,636

FISCAL AFFAIRS OF THE FOREST SERVICE.

By the terms of General Order No. 138, dated January 15, 1910, the Secretary of Agriculture placed the disbursing and accounting work of the Forest Service under the immediate supervision and direction of the Chief of the Division of Accounts and Disbursements,

[a] This includes $720,000 for state experiment stations under the regular appropriation, to be paid through the Treasury Department. Congress also appropriated $720,000 as a permanent appropriation for state experiment stations under the Adams bill to be paid through the Treasury Department. Total to be paid through the Treasury Department for state experiment stations, $1,440,000.

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who was also given authority to make, subject to the approval of the Secretary, such changes in the methods of accounting and disbursing in the Forest Service as might be deemed necessary from time to time. By the same order the fiscal agents of the Forest Service, both in Washington and at the district centers in Missoula, Mont., Denver, Colo., Albuquerque, N. Mex., Ogden, Utah, San Francisco, Cal., Portland, Oreg., and Madison, Wis., were made subject to the instructions of the Chief of the Division of Accounts in all matters pertaining to accounts and disbursements. The agricultural appropriation act of May 26, 1910 (36 Stat., 416), supplemented the Secretary's action by transferring these fiscal agents from the Forest Service to the statutory roll of the Division of Accounts and Disbursements, thus completing the change which places the Forest Service on an equal footing with the other Bureaus in regard to fiscal matters, and bringing its accounting and disbursing work under the immediate supervision and direction of the Chief of the Division of Accounts and Disbursements, who is by statute the administrative officer of the fiscal affairs of the Department of Agriculture.

The following statement, furnished by the fiscal agents of the Forest Service, is printed:

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Statement of the fiscal transactions of the Forest Service.

	District 1, Missoula.	District 2, Denver.	District 3, Albuquerque.	District 4, Ogden.	District 5, San Francisco.	District 6, Portland.	Washington, D. C.	Madison, Wis.	Total.
Requisitions issued for the purchase of supplies				471			1,595	614	2,680
Letters of authorization issued for travel	612	950	174	187	75	131	296	67	2,492
Accounts paid during the fiscal year 1910, including those paid from cooperative fund	7,506	7,771	6,950	8,005	6,874	7,243	3,404	831	48,584
Accounts paid from the appropriations for the fiscal year 1910, including cooperative fund	$720,351.04	$586,718.79	$560,988.94	$632,942.45	$620,206.55	$622,956.55	$471,001.72	$104,249.85	$4,319,415.89
Supplemental accounts paid from the appropriations for the fiscal year 1909, from July 1, 1909, to June 30, 1910, under waiver from the Treasury Department	$57,329.74	$55,876.18	$44,696.56	$54,233.37	$58,199.68	$52,924.88	$524,537.84		$847,798.25
Checks drawn during the fiscal year above mentioned in payment of accounts for 1910, and supplemental accounts for 1909	14,605	13,634	13,055	14,158	13,328	14,385	3,415	1,347	87,927
Passenger transportation requests issued	1,060	2,200	970	525	1,090	1,575	1,750	240	9,410
Requests on Quartermaster's Department for freight transportation and also on this office for departmental bills of lading for freight transportation	740	600	409	1,444	267	238	119	62	5,628
Money received from sale of condemned government property		$160.50		$15.50	$1.50				$177.50
Money received on account of lost government property	$760.90	$205.64	$117.51	$245.85	$170.51	$65.57	$40.21	$5.40	$1,611.59
Accounts forwarded to the Treasury Department for direct settlement:									
Fiscal year 1908							50		50
Fiscal year 1909							407		407
Fiscal year 1910							599		599
Checks lost in transit through the mails or by payee	25	25	9	17	28	12	1		117
Letters written in the ordinary transaction of business	4,500	4,500	3,548	2,000	1,400	4,000	4,500	600	25,048
Letters received in the ordinary transaction of business	3,048	3,000	1,116	1,600	1,600	3,000	7,500	600	21,464
Money received from timber sales, etc	$474,874.71	$380,254.96	$338,143.49	$386,565.45	$252,821.37	$257,788.10			$2,090,148.08
Money received from cooperative work	$18,000.00	$4,238.18			$345.00		$5,291.17	$800.00	$28,674.35
Requisitions drawn on the Treasury Department for advances of public funds, including temporary special disbursing agents and district fiscal agents	38	18	20	13	36	41	20	4	190
Aggregate amount of requisitions issued for the advancement of public funds to the temporary special disbursing agents and district fiscal agents	$814,570.27	$663,474.57	$604,572.80	$683,000.00	$670,365.00	$694,184.11	$526,400.00	$79,513.06	$4,736,079.81
Temporary special disbursing agents and district fiscal agents appointed during the year					2		1		3

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ANNUAL REPORT OF EXPENDITURES.

A classified statement of the expenditures of the Department for the fiscal year ended June 30, 1910 (extended to August 31, 1910), was prepared in accordance with law and will be submitted to the Committee on Expenditures. A recapitulation of the expenditures of the Department will be found below, classified as required by the committee:

Recapitulation of the several appropriations for the entire Department of Agriculture as distributed among the following groups, and the total expenditures under each.

Statutory salaries		$1,308,686.95
Lump-fund salaries in Washington		1,471,730.63
Lump-fund salaries outside of Washington		7,906,856.70
Stationery		105,591.10
Miscellaneous supplies and services, equipment, books, machinery, etc		1,947,549.27
Furniture		80,407.37
Fuel		30,165.02
Freight		33,401.75
Express		14,004.99
Telegraph		190,375.76
Telephone		42,513.85
Rent		268,028.18
Gas and electricity		25,096.65
Apparatus, instruments, and laboratory material		129,347.64
Printing and binding		3,095.54
Travel and station and field expenses		1,152,495.53
Total		14,709,346.93
Total appropriations for Department of Agriculture		15,896,845.27
Total expenditures under above groups	$14,709,346.93	
Advances to temporary special disbursing agents of the Forest Service	70,712.00	
Forest Service refunds:		
To depositors, excess deposits	48,966.86	
Payments to Uinta Indians	1,113.47	
Payments to States and Territories, 25 per cent of receipts	438,702.81	
Total expenditures of entire Department of Agriculture		15,268,842.07
Unexpended balance on August 31, 1910		628,003.20
Repayments to credit of appropriations		40,756.94
Net unexpended balance on August 31, 1910		668,760.14
Of this amount there was available for further disbursement		692.80
Balance		668,067.34
Outstanding liabilities (estimated)		312,051.81
Balance to be turned back in Treasury (estimated)		356,015.53

INSPECTION WORK.

By the terms of the agricultural appropriation act for the fiscal year 1909 there was imposed upon the Chief of the Division of Accounts and Disbursements the additional duty of acting as administrative officer of the fiscal affairs of the Department. In compliance with this provision of law and additional instructions from the

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Secretary, the disbursing officer has, at stated intervals during the year, conducted inspections of the property and financial records kept by the several Bureaus of the Department. A uniform system for the keeping of these records has been devised and installed throughout the Department as far as practicable, and the system inaugurated has done much to simplify the financial transactions between the several Bureaus and the disbursing office.

CONDITION OF WORK IN THE DIVISION.

The work of the Division is up to date, but to keep it so has taxed to the utmost the energies of the clerical force. In the appropriation act for 1911 Congress has provided several new clerks for the Division, but even with this additional force it will be difficult to keep the work from falling behind in view of the additional demands upon the Division on account of the increasing appropriations, the subdivision thereof, the preparation of several fiscal reports for Congress, the property and financial inspections in the various Bureaus, and the administrative examinations of the accounts and disbursements of the Forest Service

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FINANCES OF THE DEPARTMENT FOR SEVENTY-ONE YEARS.

Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture from the fiscal year 1839 to the fiscal year 1910, inclusive.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Collection of agricultural statistics, etc	Mar. 3, 1839	5	354	9	1839	$1,000.00	$1,000.00	.....
	Aug. 26, 1842	5	533	26	1842	1,000.00	1,000.00	.....
	Mar. 3, 1843	5	642	1	1844	2,000.00	2,000.00	.....
	June 17, 1844	5	687	1	1845	2,000.00	2,000.00	.....
	Mar. 3, 1845	5	757	1	1846	3,000.00	3,000.00	.....
	Mar. 3, 1847	9	160	1	1847	3,000.00	3,000.00	.....
	Aug. 12, 1848	9	285	1	1848	3,500.00	3,500.00	.....
Chemical analyses of vegetable substances	.....do.....	9	285	1	1848	1,000.00	1,000.00	.....
Collection of agricultural statistics, etc	Mar. 3, 1849	9	364	1	1849	3,500.00	3,500.00	.....
Chemical analyses of vegetable substances	.....do.....	9	364	1	1850	1,000.00	1,000.00	.....
Collection of agricultural statistics	Sept. 30, 1850	9	541	1	1850	4,500.00	4,500.00	.....
	Mar. 3, 1851	9	615	1	1851	5,500.00	5,500.00	.....
Collection of agricultural statistics and purchase of seeds	Aug. 31, 1852	10	95	1	1852	5,000.00	5,000.00	.....
	Mar. 3, 1853	10	208	1	1853	5,000.00	5,000.00	.....
Collection of agricultural statistics and purchase, etc., of seeds	May 31, 1854	10	292	1	1854	10,000.00	10,000.00	.....
	Aug. 4, 1854	10	567	1	1855	50,000.00	50,000.00	.....
	Mar. 3, 1855	10	664	1				
Collection of agricultural statistics, etc., and purchase, etc., of seeds	May 15, 1856	11	14	1	1856	30,000.00	30,000.00	.....
	Aug. 18, 1856	11	89	1	1857	75,000.00	75,000.00	.....
	Mar. 3, 1857	11	226	1	1858	60,000.00	60,000.00	.....
Information in relation to consumption of cotton	.....do.....	11	226	1	1858	3,500.00	3,157.25	$342.75
Collection of agricultural statistics, etc., and purchase, etc., of seeds	June 12, 1858	11	321	1	1859	60,000.00	60,000.00	.....
	Mar. 3, 1859	11	427	1	1860	40,000.00	40,000.00	.....
	June 25, 1860	12	108	1	1861	60,000.00	60,000.00	.....
	Mar. 2, 1861	12	217	1	1862	64,000.00	63,704.21	295.79
	Feb. 13, 1862	12	338	...				
Collection of agricultural statistics, etc., and purchase, etc., of seeds, including a deficiency appropriation of $20,000, made March 3, 1863	Mar. 1, 1862	12	350	1	1863	80,000.00	80,000.00	.....
Salaries	Feb. 25, 1863	12	691	1	1864	5,000.00	5,000.00	.....
Collection of agricultural statistics, etc., and purchase, etc., of seeds	.....do.....	12	691	1	1864	87,000.00	87,000.00	.....
Culture of cotton and tobacco	.....do.....	12	691	1	1864	3,000.00	3,000.00	.....
Investigations with flax and hemp	.....do.....	12	691	1	1864	20,000.00	9,500.00	10,500.00
Purchase of sorghum seed	Mar. 14, 1864	13	23	1	1864	2,000.00	2,000.00	.....
To rebuild shop in propagating garden	.....do.....	13	23	1	1864	800.00	800.00	.....
Postage	.....do.....	13	23	1	1864	1,320.00	1,320.00	.....
Furniture, carpets, fuel, etc	.....do.....	13	23	1	1864	650.00	650.00	.....
Salaries	June 25, 1864	13	155	1	1865	38,300.00	38,300.00	.....
	July 2, 1864	13	350	2				
Contingent expenses	June 25, 1864	13	155	1	1865	3,500.00	3,500.00	.....
Collecting agricultural statistics	.....do.....	13	155	1	1865	20,000.00	20,000.00	.....
Furniture, carpets, etc	.....do.....	13	155	1	1865	800.00	800.00	.....
Library and laboratory	.....do.....	13	155	1	1865	4,000.00	4,000.00	.....
Purchase and distribution of seeds	.....do.....	13	155	1	1865	61,000.00	61,000.00	.....
Experimental garden and grounds	.....do.....	13	155	1	1865	15,800.00	15,800.00	.....
To pay a debt incurred in preparing the Agricultural Report for 1861	July 2, 1864	13	350	2	1865	3,704.05	3,596.55	107.50
Rent, etc., of Commissioner's office	July 4, 1864	13	381	3	1865	3,500.00	3,500.00	.....
Salaries	Mar. 2, 1865	13	160	3	1866	46,726.59	46,726.59	.....
		13	455	1				
Contingent expenses	.....do.....	13	455	1	1866	7,500.00	7,500.00	.....
Collecting agricultural statistics	.....do.....	13	455	1	1866	20,000.00	20,000.00	.....
Purchase, etc., of seeds	.....do.....	13	160	3	1866	70,165.90	70,165.90	.....
		13	455	1				
Experimental garden and grounds, etc	.....do.....	13	160	3	1866	23,395.33	23,395.33	.....
		13	455	1				
Salaries	July 23, 1866	14	201	1	1867	39,600.00	39,600.00	.....
Contingent expenses	.....do.....	14	201	1	1867	11,500.00	11,500.00	.....

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Collecting agricultural statistics	July 23, 1866	14	201	1	1867	$10,000.00	$10,000.00	.....
Purchase of seeds	do	14	201	1	1867	115,200.00	115,200.00	.....
	do	14	202	1				
	Mar. 30, 1867	15	28	1				
Experimental garden and grounds, etc	July 23, 1866	14	202	1	1867	22,800.00	22,800.00	.....
Salaries	Mar. 2, 1867	14	451	1	1868	38,020.00	38,020.00	.....
Contingent expenses	do	14	451	1	1868	13,000.00	13,000.00	.....
Collecting agricultural statistics	do	14	451	1	1868	10,000.00	8,406.34	$1,593.66
Purchase, etc., of seeds	do	14	452	1	1868	85,200.00	85,200.00	.....
Museum	do	14	452	1	1868	10,000.00	10,000.00	.....
Experimental garden and grounds	do	14	452	1	1868	22,800.00	22,800.00	.....
To erect a building for the Department of Agriculture	do	14	464	1	1868	100,000.00	99,668.00	332.00
For certain goods and services furnished the Department	July 13, 1868	15	90	1	.....	37,604.70	37,604.70	.....
Salaries	July 20, 1868	15	105	1	1869	65,368.00	65,368.00	.....
Collecting agricultural statistics	do	15	106	1	1869	10,000.00	10,000.00	.....
Contingent expenses	do	15	196	1	1869	31,090.00	31,090.00	.....
Experimental garden and grounds	do	15	106	1	1869	23,500.00	23,500.00	.....
Purchase, etc., of seeds	do	15	106	1	1869	20,000.00	20,000.00	.....
Furniture, cases, and repairs	do	15	106	1	1869	22,635.00	22,635.00	.....
Salaries	Mar. 3, 1869	15	297	1	1870	69,240.00	67,720.00	1,520.00
		15	298	1				
Collecting agricultural statistics	do	15	298	1	1870	15,000.00	15,000.00	.....
Investigations of cattle disease	do	15	298	1	1870	15,000.00	12,695.60	2,304.40
Contingent expenses	do	15	298	1	1870	13,200.00	13,200.00	.....
Furniture, cases, and repairs	do	15	298	1	1870	2,500.00	2,500.00	.....
Experimental garden and grounds	do	15	298	1	1870	21,500.00	21,500.00	.....
Purchase, etc., of seeds	do	15	298	1	1870	20,000.00	18,981.33	1,018.67
Salaries	July 12, 1870	16	245	1	1871	71,980.00	71,811.64	168.36
	July 15, 1870	16	314	1				
Collecting agricultural statistics	July 12, 1870	16	245	1	1871	15,000.00	15,000.00	.....
Purchase, etc., of seeds	do	16	246	1	1871	30,000.00	28,865.17	1,134.83
Experimental garden and grounds	do	16	246	1	1871	53,200.00	53,200.00	.....
	July 15, 1870	16	302	1				
		16	303	1				
Contingent expenses	July 12, 1870	16	246	1	1871	8,100.00	8,100.00	.....
Furniture, cases, and repairs	do	16	246	1	1871	4,700.00	4,700.00	.....
Collecting and modeling specimens of fruit	do	16	246	1	1871	1,000.00	1,000.00	.....
Library	do	16	246	1	1871	1,000.00	1,000.00	.....
Herbarium	do	16	246	1	1871	1,000.00	1,000.00	.....
Laboratory	do	16	246	1	1871	1,700.00	1,700.00	.....
Folding room	do	16	246	1	1871	500.00	500.00	.....
Salaries	Mar. 3, 1871	16	489	1	1872	75,170.00	75,017.89	152.11
Collecting agricultural statistics	do	16	489	1	1872	15,000.00	14,059.36	940.64
Purchase and distribution of seeds, etc	do	16	489	1	1872	45,000.00	45,000.00	.....
Experimental garden and grounds	do	16	489	1	1872	36,800.00	36,800.00	.....
		16	509	1				
Contingent expenses	do	16	489	1	1872	12,900.00	12,900.00	.....
		16	490	1				
Furniture, cases, and repairs	do	16	490	1	1872	4,700.00	4,700.00	.....
Collecting and modeling specimens of fruit	do	16	490	1	1872	1,000.00	1,000.00	.....
Herbarium	do	16	490	1	1872	1,000.00	1,000.00	.....
Library	do	16	490	1	1872	2,050.00	2,050.00	.....
Laboratory	do	16	490	1	1872	3,450.00	3,450.00	.....
Salaries	May 8, 1872	17	77	1	1873	75,890.00	75,889.73	.27
Collecting agricultural statistics	do	17	77	1	1873	15,000.00	15,000.00	.....
Purchase and distribution of seeds	do	17	77	1	1873	55,000.00	55,000.00	.....

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Experimental garden and grounds	May 8, 1872 June 10, 1872	17 17	77 368	1 1	1873	$31,000.00	$31,000.00	.....
Contingent expenses	May 8, 1872	17 17	77 78	1 1	1873	13,300.00	12,507.06	$792.94
Folding room	.....do.....	17	77	1	1873	300.00	300.00	.....
Furniture, cases, and repairs	.....do.....	17	78	1	1873	5,200.00	5,200.00	.....
Museum and herbarium	.....do.....	17	78	1	1873	5,000.00	4,674.43	325.57
Library	June 10, 1872	17	369	1	1873	1,750.00	1,750.00	.....
Salaries	May 8, 1872	17	78	...	1873	78,190.00	76,924.00	1,266.00
Collecting agricultural statistics	Mar. 3, 1873	17	506	1	1874	15,000.00	11,553.20	3,446.80
Purchase and distribution of seeds, etc	.....do.....	17 17 17	506 507 540	1 1 1	1874	65,000.00	64,904.89	95.11
Experimental garden and grounds	.....do.....	17 17	507 529	1 1	1874	26,200.00	25,731.74	468.26
Museum and herbarium	.....do.....	17	507	1	1874	2,000.00	1,942.02	57.98
Contingent expenses	.....do.....	17	507	1	1874	13,600.00	12,699.34	900.66
Furniture, cases, and repairs	.....do.....	17	507	1	1874	4,200.00	3,302.40	897.60
Library	.....do.....	17	507	1	1874	1,500.00	1,259.10	240.90
Postage	.....do.....	17	542	4	1874	52,000.00	35,449.09	16,550.91
Salaries	June 20, 1874	18	107	1	1875	77,180.00	77,127.60	52.40
Collecting agricultural statistics	.....do.....	18	107	1	1875	15,000.00	12,147.56	2,852.44
Purchase and distribution of seeds, etc	.....do..... Jan. 25, 1875	18 18	107 303	1 3	1875	95,000.00	94,719.83	280.17
Furniture, cases, and repairs	June 20, 1874	18	107	1	1875	4,200.00	4,135.36	64.64
Experimental garden and grounds	.....do..... June 23, 1874	18 18	107 227	1 1	1875	24,100.00	24,094.06	5.94
Contingent expenses	June 20, 1874	18	107	1	1875	12,600.00	10,972.61	1,627.39
Museum and herbarium	.....do..... June 23, 1874	18 18	107 227	1 1	1875	4,500.00	3,300.00	1,020.00
Laboratory	.....do.....	18	227	1	1875	1,300.00	1,300.00	.....
Library	.....do.....	18	227	1	1875	1,500.00	1,087.90	412.10
Postage	June 20, 1874	18	107	1	1875	52,000.00	42,633.00	9,367.00
To publish Commissioner's report for the years 1872 and 1873	June 23, 1874	18	227	1	1875	50,000.00	49,561.91	438.09
Salaries	Mar. 3, 1875	18	368	1	1876	77,180.00	77,115.71	64.29
Collecting agricultural statistics	.....do.....	18	368	1	1876	15,000.00	14,500.00	500.00
Purchase and distribution of seeds	.....do.....	18	368	1	1876	65,000.00	65,000.00	.....
Experimental garden and grounds	.....do.....	18 18	368 394	1 1	1876	19,990.00	19,956.11	33.89
Museum and herbarium	.....do.....	18	368	1	1876	2,000.00	1,993.55	6.45
Furniture, cases, and repairs	.....do.....	18	368	1	1876	3,300.00	3,124.23	175.77
Library	.....do.....	18	368	1	1876	1,250.00	1,046.84	203.16
Laboratory	.....do.....	18	368	1	1876	1,300.00	1,300.00	.....
Contingent expenses	.....do.....	18	368	1	1876	12,100.00	11,378.91	721.09
Postage	.....do.....	18	368	1	1876	52,000.00	3,428.29	48,571.71
Salaries	July 21, 1876 Aug. 15, 1876	19 19	95 167	1 1	1877	67,836.96	67,806.19	30.77
Experimental garden and grounds	July 31, 1876 Aug. 15, 1876	19 19	115 167	1 1	1877	11,550.00	11,550.00	.....
Collecting agricultural statistics	.....do.....	19	167	1	1877	10,000.00	10,000.00	.....
Purchase and distribution of seeds, etc	.....do..... Mar. 3, 1877	19 19	167 319	1 1	1877	85,000.00	80,000.00	5,000.00
Museum and herbarium	Aug. 15, 1876	19	167	1	1877	2,000.00	2,000.00	.....
Furniture, cases, and repairs	.....do.....	19	167	1	1877	2,000.00	2,000.00	.....
Library	.....do.....	19	167	1	1877	1,000.00	800.00	200.00
Laboratory	.....do.....	19	167	1	1877	1,300.00	1,300.00	.....
Contingent expenses	.....do.....	19	167	1	1877	10,000.00	8,800.00	1,200.00
Postage	.....do.....	19	167	1	1877	4,000.00	3,950.00	50.00
Salaries	Mar. 3, 1877	19	317	1	1878	65,640.00	65,640.00	.....
Collecting agricultural statistics	.....do.....	19	317	1	1878	15,000.00	15,000.00	.....
Purchase and distribution of seeds, etc	.....do.....	19	317	1	1878	75,000.00	74,579.33	420.67
Experimental garden and grounds	.....do.....	19 19	317 360	1 1	1878	10,500.00	10,500.00	.....

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Museum	Mar. 3, 1877	19	317	1	1878	$1,500.00	$1,500.00	.....
Furniture, cases, and repairs	....do	19	317	1	1878	4,500.00	4,500.00	.....
Library	....do	19	317	1	1878	1,000.00	1,000.00	.....
Laboratory	....do	19	317	1	1878	1,000.00	1,000.00	.....
Contingent expenses	....do	19	317	1	1878	8,000.00	8,000.00	.....
Postage	....do	19	317	1	1878	4,000.00	3,415.61	$584.39
Report on forestry	....do	19	360	1	1878	2,500.00	2,500.00	.....
International Industrial Exposition at Paris	Dec. 15, 1877	20	246	4	1878	10,000.00	10,000.00	.....
Salaries	June 19, 1878	20	203	1	1879	66,900.00	66,900.00	.....
Collecting agricultural statistics	....do	20	203	1	1879	10,000.00	10,000.00	.....
Purchase and distribution of seeds, etc	....do	20	203	1	1879	75,000.00	75,000.00	.....
Experimental garden and grounds	....do	20	203	1	1879	13,500.00	13,500.00	.....
		20	240	1				
Museum	....do	20	203	1	1879	1,000.00	1,000.00	.....
Furniture, cases, and repairs	....do	20	204	1	1879	4,000.00	4,000.00	.....
Library	....do	20	204	1	1879	1,000.00	1,000.00	.....
Laboratory	....do	20	204	1	1879	1,500.00	1,500.00	.....
Contingent expenses	....do	20	204	1	1879	8,000.00	8,000.00	.....
Postage	....do	20	204	1	1879	4,000.00	3,960.00	40.00
Investigating the history and habits of insects	....do	20	204	1	1879	10,000.00	10,000.00	.....
Investigating diseases of domestic animals	....do	20	240	1	1879	10,000.00	10,000.00	.....
To erect a stable	Mar. 3, 1879	20	392	1	1879	1,500.00	1,500.00	.....
Salaries	June 21, 1879	21	23	1	1880	66,900.00	66,900.00	.....
Collecting agricultural statistics	....do	21	23	1	1880	10,000.00	9,982.88	17.12
Purchase and distribution of seeds, etc	....do	21	23	1	1880	75,000.00	75,000.00	.....
Experimental garden and grounds	....do	21	23	1	1880	13,100.00	13,100.00	.....
Museum	....do	21	23	1	1880	1,000.00	1,000.00	.....
Furniture, cases, and repairs	....do	21	23	1	1880	4,000.00	4,000.00	.....
Library	....do	21	23	1	1880	1,000.00	1,000.00	.....
Laboratory	....do	21	23	1	1880	1,500.00	1,500.00	.....
Contingent expenses	....do	21	23	1	1880	8,000.00	8,000.00	.....
Postage	....do	21	23	1	1880	4,000.00	4,000.00	.....
Investigating the history and habits of insects	....do	21	29	1	1880	5,000.00	5,000.00	.....
Investigating diseases of domestic animals	....do	21	30	1	1880	10,000.00	8,878.84	1,121.16
Salaries	June 16, 1880	21	292	1	1881	69,200.00	69,185.22	14.78
Purchase and distribution of seeds, etc	....do	21	294	1	1881	102,160.31	102,157.48	2.83
	May 3, 1881	21	453	1				
Collecting agricultural statistics	June 16, 1880	21	293	1	1881	10,000.00	9,985.60	14.40
Experimental garden and grounds	....do	21	294	1	1881	12,600.00	12,600.00	.....
Museum	....do	21	294	1	1881	1,000.00	1,000.00	.....
Furniture, cases, and repairs	....do	21	294	1	1881	5,000.00	5,000.00	.....
Library	....do	21	294	1	1881	1,000.00	1,000.00	.....
Laboratory	....do	21	295	1	1881	4,000.00	4,000.00	.....
Contingent expenses	....do	21	295	1	1881	10,000.00	9,769.17	230.83
Postage	....do	21	295	1	1881	4,000.00	3,838.00	162.00
Report on forestry	....do	21	296	1	1881	5,000.00	3,762.51	1,237.49
Investigating the history and habits of insects	....do	21	294	1	1881	5,000.00	4,997.31	2.69
Investigating the diseases of domestic animals	....do	21	295	1	1881	10,000.00	10,000.00	.....
Examination of fibers	....do	21	295	1	1881	4,000.00	4,000.00	.....
Experiments in the manufacture of sugar	....do	21	295	1	1881	7,500.00	7,500.00	.....
Collecting data touching arid regions of the United States	....do	21	295	1	1881	5,000.00	460.00	4,540.00
Reclamation of arid lands	....do	21	295	1	1881	20,000.00	18,353.55	(a)
Salaries	Mar. 3, 1881	21	381	1	1882	79,500.00	79,491.81	8.19
Collecting agricultural statistics	....do	21	382	1	1882	10,000.00	10,000.00	.....
Laboratory	....do	21	382	1	1882	6,000.00	5,811.85	188.15

a Unexpended balance of $1,646.45 carried to fiscal year 1882.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Purchase and distribution of seeds, etc.	Mar. 3, 1881 Apr. 16, 1882	21 22	382 44	1 1	1882	$100,000.00	$99,991.53	$8.47
Experiments in the culture, etc., of tea	Mar. 3, 1881	21	383	1	1882	10,000.00	8,750.87	1,249.13
Experimental garden and grounds	do	21 21	383 385	1 1	1882	15,000.00	14,968.25	31.75
Museum	do	21	383	1	1882	1,000.00	1,000.00	.....
Furniture, cases, and repairs	do	21	383	1	1882	4,000.00	4,000.00	.....
Library	do	21	383	1	1882	1,000.00	973.85	26.15
Investigating the history and habits of insects	do	21	383	1	1882	20,000.00	19,998.94	1.06
Examination of fibers	do	21	384	1	1882	5,000.00	5,000.00	.....
Investigating the diseases of domestic animals	do	21	384	1	1882	25,000.00	22,443.89	2,556.11
Collecting data touching the arid regions of the United States	do	21	384	1	1882	5,000.00	4,216.55	783.45
Reclamation of arid lands, including an unexpended balance of $1,646.45 from fiscal year 1881	do	21	384	1	1882	11,646.45	11,561.19	(a)
Report on forestry	do	21	384	1	1882	5,000.00	4,941.00	59.00
Postage	do	21	384	1	1882	4,000.00	4,000.00	.....
Contingent expenses	do	21	384	1	1882	10,000.00	10,000.00	.....
Building for display of agricultural implements	do	21	385	1	1882	10,000.00	10,000.00	.....
Experiments in the manufacture of sugar (including $864.60 from sale of molasses, etc.)	do	21	384	1	1882	35,864.60	32,333.75	(b)
Transportation of specimens from Atlanta	Feb. 13, 1882	22	3	1	1882	5,000.00	4,998.91	1.09
Salaries	May, 19, 1882	22	89	1	1883	102,580.00	102,575.49	4.51
Collecting agricultural statistics	do	22	90	1	1883	80,000.00	78,170.80	1,829.20
Laboratory	do	22	90	1	1883	6,000.00	6,000.00	.....
Purchase and distribution of seeds, etc	do	22	90	1	1883	80,000.00	80,000.00	.....
Experiments in the culture, etc., of tea	do	22	91	1	1883	5,000.00	3,905.66	1,094.34
Experimental garden and grounds	do	22 22	91 92	1 1	1883	15,500.00	15,471.82	28.18
Museum	do	22	91	1	1883	1,000.00	1,000.00	.....
Furniture, cases, and repairs	do	22	91	1	1883	6,700.00	6,700.00	.....
Library	do	22	91	1	1883	1,500.00	1,485.32	14.68
Investigating the history and habits of insects	do	22	91	1	1883	20,000.00	19,997.75	2.25
Examination of fibers	do	22	91	1	1883	10,000.00	7,961.94	2,038.06
Investigating the diseases of domestic animals	do	22	92	1	1883	25,000.00	21,584.28	3,415.72
Reclamation of arid lands, including an unexpended balance of $85.26 from fiscal year 1882	do	22	92	1	1883	20,085.26	12,429.13	(c)
Report on forestry	do	22	92	1	1883	10,000.00	8,731.99	1,268.01
Postage	do	22	92	1	1883	4,000.00	3,977.49	22.51
Contingent expenses	do	22	92	1	1883	15,000.00	14,920.74	79.26
Experiments in the manufacture of sugar, including an unexpended balance of $3,530.85 from fiscal year 1882	do	22	92	1	1883	28,530.85	28,529.31	1.54
Erection of building for seed division	Aug. 7, 1882	22	306	1	1883	25,000.00	25,000.00	.....
Report on the Angora goat	do	22	337	1	1883	500.00	500.00	.....
Salaries	Jan. 20, 1883	22	408	1	1884	127,640.00	127,639.87	.13
Collecting agricultural statistics	do	22	410	1	1884	80,000.00	79,770.86	229.14
Laboratory, and for experiments in the manufacture of sugar, including $842.18 from the sale of sirup, etc	do	22	410	1	1884	16,842.18	16,829.26	12.92

a Unexpended balance of $85.26 carried to fiscal year 1883.
b Unexpended balance of $3,530.85 carried to fiscal year 1883.
c Unexpended balance of $7,656.13 carried to fiscal year 1884.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Purchase and distribution of seeds, etc	Jan. 20, 1883	22	410	1	1884	$75,000.00	$74,986.48	$13.52
Experimental gardens and grounds	....do	22	409	1	1884	15,500.00	15,448.87	51.13
	....do	22	411	1				
Museum	....do	22	409	1	1884	1,000.00	993.51	6.49
Furniture, cases, and repairs	....do	22	410	1	1884	6,000.00	5,998.82	1.18
Library	....do	22	411	1	1884	1,500.00	1,439.86	60.14
Investigating the history and habits of insects	....do	22	409	1	1884	20,002.82	20,002.82	.....
	Aug. 4, 1886	24	273	1				
Reclamation of arid lands, including an unexpended balance of $7,656.13 from fiscal year 1883	Jan. 20, 1883	22	411	1	1884	17,656.13	16,164.68	1,491.45
Investigating the diseases of domestic animals	....do	22	411	1	1884	25,000.00	24,011.85	988.15
Report on forestry	....do	22	411	1	1884	10,000.00	9,998.30	1.70
Postage	....do	22	411	1	1884	4,000.00	3,841.48	158.52
Contingent expenses	....do	22	411	1	1884	14,000.00	13,991.43	8.57
Building of greenhouse	....do	22	631	1	1884	2,500.00	2,500.00	.....
Salaries	June 5, 1884	23	36	1	1885	137,590.00	137,557.80	32.20
Collecting agricultural statistics	....do	23	38	1	1885	100,000.00	99,986.59	13.41
Bureau of Animal Industry	May 29, 1884	23	31	1	1885	150,000.00	56,807.73	(a)
Purchase and distribution of seeds, etc	June 5, 1884	23	38	1	1885	100,000.00	99,983.82	16.18
Laboratory, and for experiments in the manufacture of sugar	....do	23	38	1	1885	50,000.00	49,996.70	3.30
Investigating the history and habits of insects	....do	23	37	1	1885	20,000.00	19,986.83	13.17
Silk culture	....do	23	39	1	1885	15,000.00	14,916.23	83.77
Contingent expenses	....do	23	39	1	1885	15,000.00	14,862.20	137.80
Report on forestry	....do	23	39	1	1885	10,000.00	9,987.36	12.64
Experimental garden and grounds	....do	23	37	1	1885	17,840.25	17,513.67	326.58
	Oct. 19, 1888	25	581	1				
Furniture, cases, and repairs	June 5, 1884	23	38	1	1885	6,000.00	5,947.27	52.73
Postage	....do	23	39	1	1885	4,000.00	3,956.98	43.02
Experiments in the culture, etc., of tea	....do	23	39	1	1885	3,000.00	2,998.90	1.10
Library	....do	23	39	1	1885	1,500.00	1,403.63	96.37
Museum	....do	23	37	1	1885	1,000.00	1,000.00	.....
Quarantine stations	June 7, 1884	23	207	1	1885	25,000.00	22,029.18	(b)
Salaries	Mar. 3, 1885	23	353	1	1886	137,590.00	137,337.42	252.58
Collecting agricultural statistics	....do	23	355	1	1886	75,000.00	68,723.06	6,276.94
Bureau of Animal Industry, including an unexpended balance of $93,192.27 from fiscal year 1885	....do	23	355	1	1886	193,192.27	58,261.05	134,931.22
Quarantine stations, including an unexpended balance of $2,970.82 for fiscal year 1885	....do	23	356	1	1886	32,970.82	18,958.57	14,012.25
Purchase and distribution of seeds, etc	....do	23	354	1	1886	100,000.00	99,980.24	19.76
Laboratory, and for experiments in the manufacture of sugar	....do	23	354	1	1886	40,000.00	39,942.11	57.89
Investigating the history and habits of insects	....do	23	354	1	1886	25,000.00	24,976.46	23.54
Silk culture	....do	23	356	1	1886	15,012.00	15,008.50	3.50
	Oct. 19, 1888	25	581	1				
Contingent expenses	Mar. 3, 1885	23	356	1	1886	15,000.00	14,937.62	62.38
Report on forestry	....do	23	356	1	1886	10,000.00	9,836.83	163.17
Experimental garden and grounds	....do	23	254	1	1886	17,208.13	17,024.88	183.25
	Aug. 4, 1886	24	273	1				
	Oct. 19, 1888	25	581	1				
Furniture, cases, and repairs	Mar. 3, 1885	23	354	1	1886	7,500.00	7,423.59	76.41
Postage	....do	23	356	1	1886	4,000.00	2,556.20	1,443.80
Experiments in the culture, etc., of tea	....do	23	356	1	1886	3,000.00	1,813.67	1,186.33
Library	....do	23	355	1	1886	1,500.00	1,417.03	82.97
Museum	....do	23	354	1	1886	1,000.00	998.88	1.12
Salaries	June 30, 1886	24	100	1	1887	142,860.00	141,420.68	1,439.32

a Unexpended balance of $93,192.27 carried to fiscal year 1886.
b Unexpended balance of $2,970.82 carried to fiscal year 1886.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Collecting agricultural statistics	June 30, 1886	24	103	1	1887	$65,000.00	$64,955.14	$44.86
Bureau of Animal Industry	do	24	103	1	1887	100,000.00	99,985.56	14.44
Quarantine stations	do	24	103	1	1887	30,000.00	10,639.44	19,360.56
Purchase and distribution of seeds, etc	do	24	102	1	1887	100,000.00	99,998.37	1.63
Laboratory	do	24	101	1	1887	6,000.00	4,570.86	1,429.14
Experiments in the manufacture of sugar, including $1,891 from sales	do	24	101	1	1887	95,891.00	95,853.14	37.86
Investigating the history and habits of insects	do	24	101	1	1887	15,096.25	15,088.05	8.20
	Oct. 19, 1888	25	582	1				
Silk culture, including $864.81 from sale of raw silk	June 30, 1886	24	101	1	1887	15,939.56	15,939.56	.....
	Oct. 19, 1888	25	581	1				
Contingent expenses	June 30, 1886	24	104	1	1887	15,000.00	14,936.83	63.17
Report on forestry	do	24	103	1	1887	8,000.00	7,953.50	46.50
Experimental garden and grounds	do	24	102	1	1887	23,200.00	22,202.15	997.85
Furniture, cases, and repairs	do	24	103	1	1887	8,125.00	8,092.11	32.89
Postage	do	24	104	1	1887	4,000.00	3,500.00	500.00
Experiments in the culture, etc., of tea	do	24	104	1	1887	2,000.00	1,753.78	246.22
Pomological information	do	24	100	1	1887	3,000.00	2,993.20	6.80
Library	do	24	103	1	1887	1,500.00	1,428.65	71.35
Botanical investigations	do	24	100	1	1887	5,000.00	4,988.12	11.88
Museum	do	24	102	1	1887	1,000.00	998.88	1.12
Ornithology and mammalogy	do	24	101	1	1887	10,000.00	9,999.98	.02
Reclamation of arid lands	do	24	103	1	1887	5,000.00	.....	5,000.00
Adulteration of food	do	24	100	1	1887	1,000.00	989.14	10.86
Salaries	Mar. 3, 1887	24	495	1	1888	161,490.00	158,220.87	3,269.13
Collecting agricultural statistics	do	24	498	1	1888	65,000.00	64,965.33	34.67
Bureau of Animal Industry, including $100,000 immediately available	do	24	499	1	1888	500,000.00	499,975.32	24.68
Quarantine stations	do	24	499	1	1888	20,000.00	9,538.75	10,461.25
Purchase and distribution of seeds, etc	do	24	498	1	1888	103,000.00	102,587.55	412.45
Laboratory	do	24	497	1	1888	6,000.00	5,969.89	30.11
Experiments in the manufacture of sugar	do	24	497	1	1888	50,000.00	49,997.43	2.57
Experiments in the manufacture of sugar (deficiency)	Oct. 19, 1888	25	582	1	1887 1888	8,000.00	7,927.50	72.50
Investigating the history and habits of insects	Mar. 3, 1887	24	497	1	1888	20,000.00	20,000.00	.....
Silk culture, including $1,989.06 from sale of raw silk	do	24	497	1	1888	16,989.06	16,989.02	.04
Contingent expenses	do	24	499	1	1888	15,000.00	14,825.57	174.43
Report on forestry	do	24	499	1	1888	8,000.00	7,996.10	3.90
Experimental garden and grounds	do	24	497	1	1888	24,800.00	24,706.86	93.14
Furniture, cases, and repairs	do	24	496	1	1888	7,000.00	6,982.88	17.12
Postage	do	24	499	1	1888	4,000.00	3,000.00	1,000.00
Pomological information	do	24	497	1	1888	3,000.00	2,971.69	28.31
Library	do	24	499	1	1888	2,000.00	1,983.78	16.22
Botanical investigations	do	24	496	1	1888	7,000.00	6,997.28	2.72
Museum	do	24	497	1	1888	1,000.00	947.41	52.59
Ornithology and mammalogy	do	24	497	1	1888	3,940.00	3,869.23	70.77
Adulteration of food	do	24	497	1	1888	1,000.00	830.16	169.84
Salaries	July 18, 1888	25	328	1	1889	171,890.32	169,152.51	2,737.81
	Mar. 2, 1889	25	923	1				
Collecting agricultural statistics	July 18, 1888	25	332	1	1889	70,000.00	69,162.45	837.55
Botanical investigations	do	25	330	1	1889	35,000.00	22,076.75	(a)
Investigating the history and habits of insects	do	25	331	1	1889	20,131.64	20,131.64	.....
	Sept. 30, 1890	26	525	1				
Ornithology and mammalogy	July 18, 1888	25	332	1	1889	5,025.90	5,022.06	3.84
	Mar. 2, 1889	25	838	1				
	Sept. 30, 1890	26	525	1				
	Mar. 3, 1891	26	880	1				
Pomological information	July 18, 1888	25	330	1	1889	4,024.48	4,020.32	4.16
		26	526	1				
Microscopical investigations	do	25	330	1	1889	1,000.00	999.87	.13
Laboratory	do	25	330	1	1889	11,000.00	9,994.25	1,005.75
	Mar. 2, 1889	25	837	1				

a Unexpended balance of $12,923.25 carried to fiscal year 1890.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Forestry investigations	July 18, 1888	25	333	1	1889	$8,000.00	$7,999.03	$0.97
Purchase and distribution of seeds	....do	25	332	1	1889	104,200.00	104,168.73	31.27
Experimental gardens and grounds	....do	25	332	1	1889	26,640.00	26,639.83	.17
Museum	....do	25	332	1	1889	1,000.00	891.25	108.75
Furniture, cases, and repairs	....do	25	333	1	1889	7,350.00	7,236.74	113.26
Library	....do	25	333	1	1889	2,000.00	1,956.34	43.66
Postage	....do	25	333	1	1889	4,000.00	4,000.00	.....
Contingent expenses	....do	25	333	1	1889	15,010.00	15,009.22	.78
	Mar. 3, 1891	26	881	1				
Office of Experiment Stations	July 18, 1888	25	334	1	1889	10,000.00	9,033.77	966.23
Experiments in the manufacture of sugar	....do	25	333	1	1889	100,000.00	41,635.24	(a)
Quarantine stations	....do	25	333	1	1889	15,000.00	11,628.39	3,371.61
Bureau of Animal Industry	....do	25	333	1	1889	500,000.00	479,623.57	20,376.43
Silk culture, including $708.26 from sale of raw silk	....do	25	331	1	1889	23,208.26	23,208.26	.....
Salaries	Mar. 2, 1889	25	835	1	1890	178,580.00	175,547.04	3,032.96
Collecting agricultural statistics	....do	25	839	1	1890	75,000.00	74,327.51	672.49
Botanical investigations, including an unexpended balance of $12,923.25 from fiscal year 1889	....do	25	836	1	1890	48,009.25	47,990.38	18.87
	July 28, 1892	27	296	1				
Investigating the history and habits of insects	Mar. 2, 1889	25	837	1	1890	20,000.00	19,892.72	107.28
Ornithology and mammalogy	....do	25	838	1	1890	7,000.00	6,994.16	5.84
	July 14, 1890	26	285	1				
Pomological information	Mar. 2, 1889	25	837	1	1890	4,304.79	4,304.79	.....
	Mar. 3, 1891	26	881	1				
Microscopical investigations	Mar. 2, 1889	25	837	1	1890	1,062.50	1,062.50	.....
	July 28, 1892	27	296	1				
Laboratory	Mar. 2, 1889	25	837	1	1890	6,000.00	5,461.99	538.01
Forestry investigations	....do	25	840	1	1890	8,000.00	7,999.96	.04
Purchase and distribution of seeds	....do	25	839	1	1890	104,200.00	104,174.55	25.45
Experimental garden and grounds	....do	25	838	1	1890	26,640.00	26,478.45	161.55
Museum	....do	25	838	1	1890	1,000.00	998.39	1.61
Furniture, cases, and repairs	....do	25	839	1	1890	9,350.00	9,261.93	88.07
	Apr. 4, 1890	26	42	1				
Library	Mar. 2, 1889	25	839	1	1890	2,000.00	1,738.28	261.72
Postage	....do	25	840	1	1890	4,000.00	4,000.00	.....
Contingent expenses	....do	25	840	1	1890	20,000.00	19,965.32	34.68
	Apr. 4, 1890	26	42	1				
Office of Experiment Stations	Mar. 2, 1889	25	840	1	1890	15,000.00	14,991.69	8.31
Experiments in the manufacture of sugar, including an unexpended balance of $58,364.76 from fiscal year 1889	....do	25	840	1	1890	83,364.76	83,064.14	300.62
Quarantine stations	....do	25	840	1	1890	15,000.00	11,266.24	3,733.76
Bureau of Animal Industry	....do	25	839	1	1890	500,000.00	311,025.31	(b)
Silk culture, including $1,627.81 from sale of raw silk	....do	25	837	1	1890	21,627.81	21,626.10	1.71
Artesian wells	Apr. 4, 1890	26	42	1	1890	20,000.00	19,652.17	347.83
Salaries	July 14, 1890	26	282	1	1891	248,902.85	239,923.29	8,979.56
Collecting agricultural statistics	....do	26	284	1	1891	100,000.00	85,126.44	14,873.56
Botanical investigations	....do	26	284	1	1891	40,000.00	36,428.36	3,571.64
Investigating the history and habits of insects	....do	26	285	1	1891	27,501.77	27,481.00	20.77
	July 28, 1892	27	296	1				
Ornithology and mammalogy	July 14, 1890	26	285	1	1891	14,004.90	13,003.67	1,001.23
	July 28, 1892	27	296	1				
Pomological information	July 14, 1890	26	285	1	1891	5,000.00	4,983.88	16.12
Microscopical investigations	....do	26	285	1	1891	5,000.00	3,281.90	1,718.10
Vegetable pathology	....do	26	285	1	1891	15,000.00	14,995.75	4.25
Laboratory	....do	26	286	1	1891	20,200.00	19,985.27	214.73
Forestry investigations	....do	26	286	1	1891	10,000.00	9,785.99	214.01
Illustrations and engravings	....do	26	286	1	1891	2,000.00	1,999.58	.42
Purchase and distribution of seeds	....do	26	286	1	1891	105,400.00	105,090.94	309.06

a Unexpended balance of $58,364.76 carried to fiscal year 1890.
b Unexpended balance of $188,974.69 carried to fiscal year 1891.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Document and folding room	July 14, 1890	26	287	1	1891	$2,000.00	$1,995.53	$4.47
Experimental garden and grounds	....do....	26	287	1	1891	28,500.00	28,396.41	103.59
Museum	....do....	26	287	1	1891	4,000.00	3,832.28	167.72
Furniture, cases, and repairs	....do....	26	287	1	1891	12,000.00	11,991.01	8.99
	Mar. 3, 1891	26	1049	1				
Library	July 14, 1890	26	287	1	1891	3,000.00	2,997.20	2.80
Postage	....do....	26	287	1	1891	5,000.00	4,833.00	167.00
Contingent expenses	....do....	26	287	1	1891	20,000.00	18,097.13	1,902.87
Office of Experiment Stations	....do....	26	288	1	1891	15,000.00	14,984.48	15.52
Experiments in the manufacture of sugar	....do....	26	288	1	1891	75,000.00	74,901.18	98.82
	Mar. 3, 1891	26	1050	1				
Irrigation investigations	Sept. 30, 1890	26	525	1	1891	40,000.00	39,926.67	73.33
Quarantine stations	July 14, 1890	26	288	1	1891	15,000.00	13,586.72	1,413.28
Bureau of Animal Industry, including an unexpended balance of $188,974.09 from fiscal year 1890	....do....	26	287	1	1891	538,974.69	469,113.35	69,861.34
Silk culture, including $565 from sale of raw silk	....do....	26	285	1	1891	20,565.00	19,536.33	1,028.67
Salaries	Mar. 3, 1891	26	1045	1	1892	256,800.00	252,766.17	4,033.83
Collecting agricultural statistics	....do....	26	1046	1	1892	102,500.00	88,869.51	13,630.49
Botanical investigations	....do....	26	1046	1	1892	40,246.40	40,246.40	.....
	Aug. 23, 1894	28	440	1				
Investigating the history and habits of insects	Mar. 3, 1891	26	1047	1	1892	27,800.00	27,780.03	19.97
Ornithology and mammalogy	....do....	26	1047	1	1892	15,000.00	14,688.00	312.00
Pomological information	....do....	26	1047	1	1892	5,000.00	4,985.27	14.73
Microscopical investigations	....do....	26	1047	1	1892	2,000.00	1,251.46	748.54
Vegetable pathology	....do....	26	1047	1	1892	15,076.47	15,076.47	.....
	Aug. 23, 1894	28	440	1				
Laboratory	Mar. 3, 1891	26	1047	1	1892	19,400.00	19,272.59	127.41
Fiber investigations	....do....	26	1048	1	1892	10,000.00	8,017.44	1,982.56
Forestry investigations	....do....	26	1048	1	1892	15,056.85	15,056.85	.....
	Mar. 3, 1893	27	660	1				
Illustrations and engravings	Mar. 3, 1891	26	1048	1	1892	2,000.00	1,999.85	.15
Purchase and distribution of seeds	....do....	26	1048	1	1892	105,400.00	104,920.35	479.65
Document and folding room	....do....	26	1049	1	1892	2,000.00	1,996.82	3.18
Experimental garden and grounds	....do....	26	1049	1	1892	28,622.53	28,536.67	85.86
	Mar. 3, 1893	27	660	1				
Museum	Mar. 3, 1891	26	1049	1	1892	4,000.00	3,909.17	90.83
Furniture, cases, and repairs	....do....	26	1049	1	1892	10,000.00	9,996.55	3.45
Library	....do....	26	1049	1	1892	3,000.00	2,807.75	192.25
Postage	....do....	26	1049	1	1892	5,000.00	4,900.00	100.00
Contingent expenses	....do....	26	1049	1	1892	25,000.00	24,762.32	237.68
Office of Experiment Stations	....do....	26	1050	1	1892	20,000.00	19,989.47	10.53
Experiments in the manufacture of sugar	....do....	26	1050	1	1892	35,000.00	34,627.78	372.22
	Mar. 18, 1892	27	7	1				
Quarantine stations	Mar. 3, 1891	26	1050	1	1892	15,000.00	14,983.63	16.37
Bureau of Animal Industry	....do....	26	1045	1	1892	650,000.00	649,980.91	19.09
	Mar. 18, 1892	27	7	1				
Weather Bureau	Mar. 3, 1891	26	1051	1	1892	889,753.50	861,840.83	27,912.67
Salaries	July 5, 1892	27	74	1	1893	256,800.00	253,896.30	2,903.70
Collecting agricultural statistics	....do....	27	76	1	1893	110,000.00	95,649.21	14,350.79
Botanical investigations and experiments	....do....	27	76	1	1893	27,500.00	27,451.55	48.45
Investigating the history and habits of insects	....do....	27	77	1	1893	17,800.00	17,290.80	509.20
Investigations in ornithology and mammalogy	....do....	27	77	1	1893	15,000.00	14,947.77	52.23
Pomological information	....do....	27	77	1	1893	5,000.00	4,745.94	254.06
Microscopical investigations	....do....	27	77	1	1893	2,000.00	1,982.98	17.02
Vegetable pathology	....do....	27	77	1	1893	20,000.00	19,977.38	22.62
Laboratory	....do....	27	77	1	1893	19,400.00	18,002.59	1,397.41
Fiber investigations	....do....	27	78	1	1893	5,000.00	4,997.07	2.93
Forest investigations	....do....	27	78	1	1893	12,000.00	11,933.39	66.61
Illustrations and engravings	....do....	27	78	1	1893	2,000.00	1,906.73	93.27
Purchase and distribution of seeds	....do....	27	78	1	1893	135,400.00	134,908.27	491.73
Document and folding room	....do....	27	78	1	1893	2,000.00	1,623.55	376.45
Experimental garden and grounds	....do....	27	78	1	1893	28,500.00	28,115.09	384.91

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Museum	July 5, 1892	27	79	1	1893	$4,000.00	$3,973.67	$26.33
Furniture, cases, and repairs	....do	27	79	1	1893	10,000.00	8,931.97	1,068.03
Library	....do	27	79	1	1893	3,000.00	2,535.29	464.71
Postage	....do	27	79	1	1893	5,000.00	3,705.00	1,295.00
Contingent expenses	....do	27	79	1	1893	25,000.00	22,218.19	2,781.81
Experiment stations	....do	27	80	1	1893	20,000.00	18,987.65	1,012.35
Experiments in the manufacture of sugar	....do	27	80	1	1893	20,000.00	19,984.86	15.14
Irrigation investigations	....do	27	76	1	1893	6,000.00	4,930.67	1,069.33
Quarantine stations	....do	27	80	1	1893	15,000.00	12,633.23	2,366.77
Experiments in the production of rainfall	....do	27	76	1	1893	10,000.00	4,979.59	5,020.41
Bureau of Animal Industry	....do	27	79	1	1893	850,000.00	724,696.74	125,303.26
Weather Bureau	....do	27	81	1	1893	913,660.72	890,424.77	23,235.95
Salaries	Mar. 3, 1893	27	734	1	1894	256,800.00	233,679.75	23,120.25
Collecting agricultural statistics	....do	27	736 737	1	1894	110,000.00	91,080.20	18,919.80
Botanical investigations and experiments	....do	27	737	1	1894	30,000.00	24,401.40	5,598.60
Investigating the history and habits of insects	....do	27	737	1	1894	20,300.00	16,203.96	4,096.04
Investigations in ornithology and mammalogy	....do	27	737	1	1894	17,500.00	17,450.00	50.00
Pomological information	....do	27	738	1	1894	5,000.00	4,248.99	751.01
Microscopical investigations	....do	27	738	1	1894	2,000.00	1,117.55	882.45
Vegetable pathology	....do	27	738	1	1894	20,000.00	17,576.95	2,423.05
Laboratory	....do	27	738	1	1894	21,900.00	10,426.79	11,473.21
Fiber investigations	....do	27	738	1	1894	5,000.00	2,500.47	2,499.53
Forestry investigations	....do	27	738	1	1894	20,000.00	19,995.96	4.04
Illustrations and engravings	....do	27	738	1	1894	2,000.00	664.79	1,335.21
Purchase and distribution of seeds	....do	27	738	1	1894	135,400.00	119,719.76	15,680.24
Document and folding room	....do	27	739	1	1894	2,000.00	1,662.81	337.19
Experimental garden and grounds	....do	27	739	1	1894	31,500.00	26,616.86	4,883.14
Museum	....do	27	739	1	1894	4,000.00	2,787.22	1,212.78
Furniture, cases, and repairs	....do	27	739	1	1894	10,000.00	8,628.76	1,371.24
Library	....do	27	739	1	1894	3,000.00	2,900.07	99.93
Postage	....do	27	740	1	1894	5,000.00	1,375.00	3,625.00
Contingent expenses	....do	27	740	1	1894	25,000.00	20,493.04	4,506.96
Experiment stations	....do	27	740	1	1894	25,223.50	22,381.85	2,841.65
Inquiries relating to public roads	....do	27	737	1	1894	10,000.00	2,997.39	7,002.61
Experiments in the manufacture of sugar	....do	27	741	1	1894	20,107.33	9,451.80	10,655.53
Irrigation investigations	....do	27	741	1	1894	6,000.00	5,475.92	524.08
Quarantine stations	....do	27	740	1	1894	15,000.00	6,263.92	8,736.08
Bureau of Animal Industry	....do	27	740	1	1894	850,000.00	496,111.34	353,888.66
Weather Bureau	....do	27	741	1	1894	951,124.75	811,256.73	139,868.02
Salaries	Aug. 18, 1894	28	266	1	1895	249,876.16	204,589.72	45,286.44
Collecting agricultural statistics	....do	28	266	1	1895	110,000.00	95,125.67	14,874.33
Botanical investigations and experiments	....do	28	267	1	1895	30,000.00	25,695.30	4,304.70
Investigating the history and habits of insects	....do	28	267	1	1895	20,300.00	16,822.87	3,477.13
Investigations in ornithology, etc	....do	28	267	1	1895	17,500.00	15,526.35	1,973.65
Pomological information	....do	28	267	1	1895	5,000.00	4,920.23	79.77
Microscopical investigations	....do	28	267	1	1895	2,000.00	313.87	1,686.13
Vegetable pathological investigations, etc	....do	28	267	1	1895	20,000.00	19,063.69	936.31
Laboratory	....do	28	267	1	1895	14,900.00	11,010.50	3,889.50
Fiber investigations	....do	28	271	1	1895	5,000.00	3,973.81	1,026.19
Report on forestry	....do	28	268	1	1895	20,000.00	19,908.23	91.77
Illustrations and engravings	....do	28	268	1	1895	15,000.00	9,114.71	5,885.29
Purchase and distribution of valuable seeds	....do	28	269	1	1895	165,400.00	120,545.15	44,854.85
Document and folding room	....do	28	268	1	1895	2,000.00	1,166.83	833.17
Experimental gardens and grounds	....do	28	268	1	1895	29,500.00	23,578.11	5,921.89
Museum	....do	28	271	1	1895	3,000.00	1,889.73	1,110.27
Furniture, cases, and repairs	....do	28	271	1	1895	10,000.00	7,952.27	2,047.73
Library	....do	28	272	1	1895	6,000.00	5,963.20	36.80
Postage	....do	28	271	1	1895	5,000.00	765.00	4,235.00
Nutrition investigations	....do	28	271	1	1895	10,000.00	9,746.30	253.70

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Contingent expenses	Aug. 18,1894	28	272	1	1895	[a]$25,000.00	$20,452.79	$4,547.21
Agricultural experiment stations	.....do.....	28	271	1	1895	25,000.00	24,928.22	71.78
Inquiries relating to public roads	.....do.....	28	266	1	1895	10,000.00	6,901.66	3,098.34
Experiments in the manufacture of sugar	.....do.....	28	271	1	1895	10,000.00	6,188.80	3,811.20
Irrigation investigations	.....do.....	28	271	1	1895	6,000.00	3,904.88	2,095.12
Quarantine stations for neat cattle	.....do.....	28	269	1	1895	12,000.00	6,262.17	5,737.83
Bureau of Animal Industry	.....do.....	28	269	1	1895	800,000.00	534,028.38	265,971.62
Weather Bureau	.....do.....	28	272	1	1895	878,438.84	820,691.94	57,746.90
Salaries	Mar. 2,1895	28	727	1	1896	252,840.00	217,066.97	35,773.03
Collecting agricultural statistics	.....do.....	28	729	1	1896	110,000.00	68,628.99	41,371.01
Inquiries relating to public roads	.....do.....	28	729	1	1896	10,000.00	9,568.39	431.61
Botanical investigations and experiments	.....do.....	28	730	1	1896	25,000.00	20,325.37	4,674.63
Investigating the history and habits of insects	.....do.....	28	730	1	1896	20,000.00	17,372.43	2,627.57
Investigations in ornithology and mammalogy	.....do.....	28	730	1	1896	17,500.00	16,175.45	1,324.55
Pomological information	.....do.....	28	730	1	1896	6,000.00	4,996.41	1,003.59
Microscopical investigations	.....do.....	28	730	1	1896	2,000.00	.....	2,000.00
Vegetable pathological investigations and experiments	.....do.....	28	730	1	1896	20,000.00	18,539.18	1,460.82
Laboratory	.....do.....	28	730	1	1896	14,909.00	11,458.53	3,441.47
Report on forestry	.....do.....	28	731	1	1896	25,000.00	18,398.12	6,601.88
Illustrations and engravings	.....do.....	28	731	1	1896	15,000.00	12,985.71	2,014.29
Document and folding room	.....do.....	28	731	1	1896	2,000.00	1,061.23	938.77
Experimental gardens and grounds	.....do.....	28	731	1	1896	29,500.00	22,371.15	7,128.85
Quarantine stations for neat cattle	.....do.....	28	733	1	1896	12,000.00	6,492.05	5,507.95
Purchase and distribution of valuable seeds	.....do.....	28	733	1	1896	185,400.00	126,476.87	58,923.13
Experiments in the manufacture of sugar	.....do.....	28	734	1	1896	10,000.00	1,510.94	8,489.06
Agricultural experiment stations ($750,000[a])	.....do.....	28	734	1	1896	[b]30,143.75	27,712.86	2,430.89
Irrigation investigations	.....do.....	28	735	1	1896	15,000.00	5,029.82	9,970.18
Nutrition investigations	.....do.....	28	735	1	1896	15,000.00	14,892.96	107.04
Investigations and experiments with grasses and forage plants	.....do.....	28	735	1	1896	15,000.00	13,329.47	1,670.53
Investigations in relation to agricultural soils	.....do.....	28	735	1	1896	15,000.00	13,524.84	1,475.16
Furniture, cases, and repairs	.....do.....	28	735	1	1896	10,000.00	8,645.98	1,354.02
Postage	.....do.....	28	735	1	1896	2,000.00	1,215.00	785.00
Museum	.....do.....	28	735	1	1896	3,000.00	2,161.90	838.10
Fiber investigations	.....do.....	28	735	1	1896	5,000.00	3,710.36	1,289.64
Library	.....do.....	28	735	1	1896	6,000.00	5,431.92	568.08
Contingent expenses	.....do.....	28	736	1	1896	25,000.00	15,912.71	9,087.29
Bureau of Animal Industry	.....do.....	28	731	1	1896	800,000.00	595,336.64	204,663.36
Weather Bureau	.....do.....	28	736	1	1896	[c]885,729.47	814,584.17	71,145.30
Salaries	Apr. 25,1896	29	99	1	1897	313,860.00	290,791.95	23,068.05
Furniture, cases, and repairs	.....do.....	29	105	1	1897	12,000.00	9,567.59	2,432.41
Library	.....do.....	29	104	1	1897	7,000.00	6,831.15	168.85
Museum	.....do.....	29	105	1	1897	3,000.00	2,895.45	104.55
Postage	.....do.....	29	105	1	1897	3,000.00	1,730.00	1,270.00
Contingent expenses	.....do.....	29	105	1	1897	25,000.00	22,980.29	2,019.71
Animal quarantine stations	.....do.....	29	105	1	1897	12,000.00	6,564.19	5,435.81
Collecting agricultural statistics	.....do.....	29	101	1	1897	110,000.00	83,067.62	26,932.38
Botanical investigations and experiments	.....do.....	29	101	1	1897	15,000.00	14,999.64	.36
Entomological investigations	.....do.....	29	102	1	1897	20,000.00	18,637.01	1,362.99
Vegetable pathological investigations	.....do.....	29	102	1	1897	20,000.00	19,274.15	725.85
Biological investigations	.... do.....	29	102	1	1897	17,500.00	17,483.05	16.95
Pomological investigations	.....do.....	29	102	1	1897	6,000.00	4,981.52	1,018.48

[a] Of this amount $720,000 was paid directly to the experiment stations from the Treasury Department.

[b] Includes $143.75 from the sale of card index.

[c] Includes $119.47 from the sale of Weather Bureau publications.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Laboratory	Apr. 25, 1896	29	102	1	1897	$12,400.00	$10,900.18	$1,599.82
Forestry investigations	....do....	29	103	1	1897	20,000.00	19,514.88	485.12
Experimental gardens and grounds	....do....	29	103	1	1897	20,000.00	19,483.28	516.72
Soil investigations	....do....	29	103	1	1897	10,000.00	9,868.16	131.84
Grass and forage plant investigations	....do....	29	103	1	1897	10,000.00	9,203.14	796.86
Fiber investigations	....do....	29	103	1	1897	5,000.00	4,143.00	857.00
Agricultural experiment stations ($750,000) [a]	....do....	29	103	1	1897	[b] 30,127.25	29,171.57	955.68
Nutrition investigations	....do....	29	104	1	1897	15,000.00	14,821.64	178.36
Public road inquiries	....do....	29	104	1	1897	8,000.00	7,873.97	126.03
Publications	....do....	29	104	1	1897	70,000.00	67,709.89	2,290.11
Purchase and distribution of valuable seeds	....do....	29	106	1	1897	150,000.00	142,822.52	7,177.48
Bureau of Animal Industry	....do....	29	106	1	1897	650,000.00	642,715.68	7,284.32
Weather Bureau	....do....	29	107	1	1897	[c] 883,876.28	870,581.46	13,294.82
Salaries, officers and clerks	Apr. 23, 1897	30	1	1	1898	319,300.00	285,181.30 18,962.98 9,811.02	5,118.70 37.02 188.98
Furniture, cases, and repairs	....do....	30	8	1	1898	9,000.00	7,851.30	1,148.70
Library	....do....	30	7	1	1898	7,000.00	6,734.81	265.19
Museum	....do....	30	8	1	1898	3,000.00	2,906.02	93.98
Postage	....do....	30	8	1	1898	3,000.00	1,500.00	1,500.00
Contingent expenses	....do....	30	8	1	1898	25,000.00	22,061.73	2,938.27
Animal quarantine stations	....do....	30	7	1	1898	12,000.00	10,897.98	1,102.02
Collecting agricultural statistics	....do....	30	3	1	1898	110,000.00	92,896.01 9,021.09	7,103.99 978.91
Botanical investigations and experiments	....do....	30	4	1	1898	15,000.00	14,714.50	285.50
Entomological investigations	....do....	30	4	1	1898	20,000.00	19,735.02	264.98
Vegetable pathological investigations	....do....	30	4	1	1898	20,000.00	18,966.67 660.00	373.33 .....
Biological investigations	....do....	30	4	1	1898	17,500.00	16,160.90	1,339.10
Pomological investigations	....do....	30	4	1	1898	8,000.00	7,487.93	512.07
Laboratory	....do....	30	5	1	1898	12,400.00	3,913.86 900.00 6,718.71	86.14 ..... 781.29
Forestry investigations	....do....	30	5	1	1898	20,000.00	19,831.32	168.68
Experimental gardens and grounds	....do....	30	5	1	1898	25,000.00	24,937.31	62.69
Soil investigations	....do....	30	5	1	1898	10,000.00	9,199.82 660.00	140.18 .....
Grass and forage plant investigations	....do....	30	6	1	1898	10,000.00	8,877.68	1,122.32
Fiber investigations	....do....	30	6	1	1898	5,000.00	3,659.05	1,340.95
Agricultural experiment stations ($755,000 [a])	....do....	30	6	1	1898	35,000.00	29,413.10 4,925.80	596.90 74.20
Nutrition investigations	....do....	30	6	1	1898	15,000.00	14,872.88	127.12
Public road inquiries	....do....	30	7	1	1898	8,000.00	7,978.44	21.56
Publications, including Farmers' Bulletins	....do....	30	7	1	1898	65,000.00	34,966.55 29,812.59	33.45 187.41
Investigating production of domestic sugar	....do....	30	39	1	1898	5,000.00	4,941.32	58.68
Purchase and distribution of valuable seeds	....do....	30	8	1	1898	130,000.00	121,870.38	8,129.62
Salaries and expenses, Bureau of Animal Industry	....do....	30	9	1	1898	675,000.00	673,444.02 1,200.00	355.98 .....
Weather Bureau	....do....	30	9	1	1898	883,702.00	877,838.35	5,863.65
Salaries, officers and clerks	Mar. 22, 1898	30	330	1	1899	319,300.00	315,986.70	3,313.30
Furniture, cases, and repairs	....do....	30	336	1	1899	9,000.00	8,667.75	332.25
Library	....do....	30	336	1	1899	6,000.00	5,659.51	340.49
Museum	....do....	30	336	1	1899	1,500.00	1,465.36	34.64
Postage	....do....	30	336	1	1899	2,000.00	2,000.00	.....
Contingent expenses	....do....	30	337	1	1899	25,000.00	23,888.08	1,111.92
Animal quarantine stations	....do....	30	336	1	1899	12,000.00	11,833.38	166.62
Collecting agricultural statistics	....do....	30	333	1	1899	105,000.00	100,952.48	4,047.52
Botanical investigations and experiments	....do....	30	333	1	1899	20,000.00	19,972.07	27.93

[a] Of this amount $720,000 was paid directly to the experiment stations from the Treasury Department.
[b] Includes $127.25 from the sale of card index.
[c] Includes $104.28 from the sale of Weather Bureau publications.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Entomological investigations	Mar. 22, 1898	30	333	1	1899	$20,000.00	$19,812.64	$187.36
Vegetable pathological investigations	....do....	30	333	1	1899	20,000.00	19,634.32	365.68
Biological investigations	....do....	30	334	1	1899	17,500.00	17,373.26	126.74
Pomological investigations	....do....	30	334	1	1899	9,500.00	8,248.18	1,251.82
Laboratory	....do....	30	334	1	1899	12,400.00	12,028.15	371.85
Forestry investigations	....do....	30	334	1	1899	20,000.00	19,520.52	469.48
Experimental gardens and grounds	....do....	30	334	1	1899	20,000.00	19,879.66	120.34
Soil investigations	....do....	30	334	1	1899	10,000.00	9,885.85	114.15
Grass and forage plant investigations	....do....	30	335	1	1899	10,000.00	9,950.99	49.01
Irrigation information	....do....	30	335	1	1899	10,000.00	9,997.49	2.51
Agricultural experiment stations ($760,000 a)	....do....	30	335	1	1899	40,000.00	39,536.38	463.62
Nutrition investigations	....do....	30	335	1	1899	15,000.00	14,903.08	96.92
Public road inquiries	....do....	30	336	1	1899	8,000.00	7,469.50	530.50
Publications	....do....	30	336	1	1899	65,000.00	64,773.62	226.38
Purchase and distribution of valuable seeds	....do....	30	337	1	1899	130,000.00	128,350.61	1,649.39
Investigating production of domestic sugar	....do....	30	338	1	1899	7,000.00	6,860.30	139.70
Salaries and expenses, Bureau of Animal Industry	....do....	30	338	1	1899	900,000.00	b 920,164.47	6,828.45
Weather Bureau	....do....	30	339	1	1899	1,015,502.00	1,008,971.30	6,530.70
Salaries, officers and clerks	Mar. 1,1899	30	947	1	1900	336,340.00	330,666.24	5,673.76
Furniture, cases, and repairs	....do....	30	955	1	1900	10,000.00	9,771.27	228.73
Library	....do....	30	954	1	1900	5,000.00	4,291.17	708.83
Museum	....do....	30	954	1	1900	1,500.00	1,490.01	9.99
Postage	....do....	30	954	1	1900	2,000.00	2,000.00	.....
Contingent expenses	....do....	30	955	1	1900	25,000.00	23,769.38	1,230.62
Animal quarantine stations	....do....	30	954	1	1900	12,000.00	11,477.87	522.13
Collecting agricultural statistics	....do....	30	950	1	1900	110,000.00	107,653.62	2,346.38
Botanical investigations and experiments	....do....	30	950	1	1900	20,000.00	19,689.51	310.49
Entomological investigations	....do....	30	951	1	1900	20,000.00	19,920.64	79.36
Vegetable pathological investigations	....do....	30	951	1	1900	26,000.00	25,854.44	145.56
Biological investigations	....do....	30	951	1	1900	17,500.00	17,344.00	156.00
Pomological investigations	....do....	30	951	1	1900	9,500.00	9,099.61	400.39
Laboratory	....do....	30	951	1	1900	17,700.00	17,182.80	517.20
Forestry investigations	....do....	30	952	1	1900	40,000.00	39,991.49	8.51
Experimental gardens and grounds	....do....	30	952	1	1900	28,000.00	27,589.66	410.34
Soil investigations	....do....	30	952	1	1900	20,000.00	19,717.02	282.98
Grass and forage plant investigations	....do....	30	952	1	1900	12,000.00	11,566.84	433.16
Irrigation investigations	....do....	30	953	1	1900	35,000.00	33,732.57	1,267.43
Agricultural experiment stations ($765,000 a)	....do....	30	953	1	1900	45,000.00	43,702.20	1 297.80
Nutrition investigations	....do....	30	953	1	1900	15,000.00	14,950.86	49.14
Public road inquiries	....do....	30	954	1	1900	8,000.00	7,854.35	145.65
Publications	....do....	30	954	1	1900	80,000.00	79,516.76	483.24
Purchase and distribution of valuable seeds	....do....	30	955	1	1900	130,000.00	128,366.13	1,633.87
Investigating production of domestic sugar	....do....	30	956	1	1900	7,000.00	6,717.82	282.18
Tea-culture investigations	....do....	30	956	1	1900	1,000.00	999.33	.67
Salaries and expenses, Bureau of Animal Industry	....do....	30	956	1	1900	950,000.00	918,449.03	31,550.97
Weather Bureau	....do....	30	957	1	1900	1,022,482.00	1,014,238.80	8,243.20
Salaries, officers and clerks	May 20, 1900	31	191	1	1901	326,680.00	319,809.25	6,870.75
Library	....do....	31	194	1	1901	5,000.00	4,118.93	881.07
Contingent expenses	....do....	31	194	1	1901	37,000.00	35,623.95	1,376.05
Animal quarantine stations	....do....	31	194	1	1901	50,000.00	49,343.52	656.48
Collecting agricultural statistics	....do....	31	194	1	1901	110,000.00	109,729.76	270.24
Botanical investigations and experiments	....do....	31	195	1	1901	30,000.00	29,590.49	409.51
Entomological investigations	....do....	31	195	1	1901	22,500.00	22,265.57	234.43
Vegetable pathological investigations	....do....	31	195	1	1901	28,000.00	27,488.57	511.43

a Of this amount $720,000 was paid directly to the experiment stations from the Treasury Department.
b Includes $26,992.92 received from sale of American products in Europe.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Biological investigations	Mar. 1, 1899	31	196	1	1901	$17,500.00	$17,195.83	$304.17
Pomological investigations	....do	31	196	1	1901	9,500.00	9,315.11	184.89
Laboratory	....do	31	196	1	1901	28,500.00	28,395.45	104.55
Forestry investigations	....do	31	197	1	1901	80,000.00	79,695.87	304.13
Experimental gardens and grounds	....do	31	197	1	1901	20,000.00	19,986.72	13.28
Soil investigations	....do	31	197	1	1901	25,000.00	24,924.94	75.06
Grass and forage plant investigations	....do	31	198	1	1901	17,000.00	15,225.83	1,774.17
Irrigation investigations	....do	31	199	1	1901	50,000.00	49,973.09	26.91
Agricultural experiment stations ($780,000[a])	....do	31	198	1	1901	[b] 60,251.01	59,883.47	367.54
Nutrition investigations	....do	31	199	1	1901	17,500.00	17,499.67	.33
Arlington experimental farm	....do	31	199	1	1901	10,000.00	9,946.03	53.97
Public road inquiries	....do	31	200	1	1901	14,000.00	13,990.76	9.24
Publications	....do	31	200	1	1901	105,000.00	104,680.67	319.33
Purchase and distribution of valuable seeds	....do	31	200	1	1901	170,000.00	149,615.49	20,384.51
Investigating production of domestic sugar	....do	31	201	1	1901	7,000.00	6,690.25	309.75
Tea-culture investigations	....do	31	202	1	1901	5,000.00	4,959.42	40.58
Salaries and expenses, Bureau of Animal Industry	....do	31	202	1	1901	[c] 1,000,514.96	976,566.75	23,948.21
Salaries, Weather Bureau	....do	31	202	1	1901	153,320.00	152,688.11	631.89
Fuel, lights, and repairs, Weather Bureau	....do	31	203	1	1901	9,000.00	8,877.36	122.64
Contingent expenses, Weather Bureau	....do	31	203	1	1901	8,000.00	7,906.40	93.60
General expenses, Weather Bureau	....do	31	203	1	1901	828,000.00	823,921.78	4,078.22
Meteorological Observation Stations, Weather Bureau	....do	31	204	1	1901	60,000.00	59,019.49	980.51
Salaries	Mar. 2, 1901	31	922	1	1902	373,820.00	370,039.69	3,780.31
Library	....do	31	934	1	1902	7,000.00	6,754.06	245.94
Contingent expenses	....do	31	934	1	1902	37,000.00	34,543.24	2,456.76
Animal quarantine stations	....do	31	926	1	1902	25,000.00	24,814.88	185.12
Collecting agricultural statistics	....do	31	934	1	1902	120,000.00	117,060.06	2,939.94
Botanical investigations and experiments	....do	31	928	1	1902	45,000.00	44,950.93	49.07
Entomological investigations	....do	31	931	1	1902	28,513.18	27,069.77	1,443.41
Vegetable pathological investigations	....do	31	927	1	1902	60,000.00	59,999.45	.55
Biological investigations	....do	31	932	1	1902	20,000.00	19,807.80	192.20
Pomological investigations	....do	31	927	1	1902	20,000.00	19,985.14	14.86
Laboratory	....do	31	930	1	1902	24,500.00	24,417.47	82.53
Forestry investigations	....do	31	929	1	1902	146,280.00	145,809.76	470.24
Experimental gardens and grounds	....do	31	929	1	1902	20,000.00	19,725.80	274.20
Soil investigations	....do	31	931	1	1902	91,000.00	89,987.21	1,012.79
Grass and forage plant investigations	....do	31	928	1	1902	20,000.00	19,566.91	433.09
Irrigation investigations	....do	31	936	1	1902	50,000.00	49,980.86	19.14
Agricultural experiment stations ($780,000[a])	....do	31	935	1	1902	[d] 69,157.05	69,052.71	104.34
Nutrition investigations	....do	31	936	1	1902	20,000.00	19,951.48	48.52
Arlington experimental farm	....do	31	936	1	1902	10,000.00	9,897.16	102.84
Plans for building Department of Agriculture, 1901-2	....do	31	938	1	1902	5,000.00	5,000.00	.....
Public road inquiries	....do	31	938	1	1902	20,000.00	19,957.01	42.99
Publications	....do	31	933	1	1902	188,000.00	187,657.52	342.48
Purchase and distribution of valuable seeds	....do	31	937	1	1902	270,000.00	266,614.22	3,385.78
Investigating production of domestic sugar	....do	31	936	1	1902	5,000.00	4,346.31	653.69
Tea-culture investigations	....do	31	937	1	1902	7,000.00	6,816.25	183.75
Bureau of Animal Industry	....do	31	925	1	1902	1,092,190.28	1,092,100.94	89.34
Weather Bureau:								
Salaries	....do	31	923	1	1902	159,820.00	159,769.71	50.29
Fuel, lights, and repairs	....do	31	923	1	1902	9,000.00	8,919.71	80.29

[a] Of this amount $720,000 was paid directly to the experiment stations from the Treasury Department.
[b] Including $251.01 received from sales of card index.
[c] Including $514.96 received from sales of American butter in foreign markets.
[d] Including $157.05 received from sales of card index.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Weather Bureau—Continued.								
Contingent expenses	Mar. 2, 1901	31	923	1	1902	$8,000.00	$7,942.81	$57.19
General expenses	....do....	31	923	1	1902	865,500.00	864,490.74	1,009.26
Meteorological observation stations	....do....	31	924	1	1902	60,000.00	59,646.49	353.51
Buildings	....do....	31	924	1	1902	46,000.00	46,000.00	.....
Salaries	June 3, 1902	32	286	1	1903	465,500.00	450,976.17	14,523.83
Library	....do....	32	300	1	1903	8,000.00	7,635.11	364.89
Contingent expenses	....do....	32	301	1	1903	37,000.00	42,916.14	83.86
Urgent deficiency, contingent	....do....	32	1062	1	1903	6,000.00		
Vegetable pathological investigations	....do....	32	291	1	1903	105,000.00	103,646.28	1,353.72
Vegetable pathological investigations, 1902–3	....do....	32	1152	1	1903	5,000.00	4,130.02	869.98
Pomological investigations	....do....	32	291	1	1903	30,000.00	29,606.83	393.17
Botanical investigations and experiments	....do....	32	292	1	1903	55,000.00	54,900.42	99.58
Grass and forage plant investigations	....do....	32	292	1	1903	30,000.00	29,527.41	472.59
Experimental gardens and grounds	....do....	32	293	1	1903	25,000.00	24,935.74	64.26
Arlington Experimental Farm	....do....	32	293	1	1903	15,000.00	14,998.81	1.19
Investigating production of domestic sugar	....do....	32	295	1	1903	5,000.00	4,065.10	934.90
Tea-culture investigations	....do....	32	293	1	1903	10,000.00	7,500.10	2,499.90
Purchase and distribution of valuable seeds	....do....	32	293	1	1903	270,000.00	266,229.81	3,770.19
Forestry investigations	....do....	32	295	1	1903	254,000.00	244,781.68	9,218.32
Laboratory	....do....	32	296	1	1903	60,500.00	59,518.91	918.09
Soil investigations	....do....	32	297	1	1903	130,000.00	128,408.15	1,591.85
Entomological investigations	....do....	32	298	1	1903	37,500.00	37,485.44	14.56
Entomological investigations, 1902–3	....do....	32	298	1	1903	8,000.00	7,989.42	10.58
Biological investigations	....do....	32	298	1	1903	26,000.00	25,616.80	383.20
Biological investigations, 1902–3	....do....	32	298	1	1903	2,000.00	1,949.61	50.39
Urgent deficiency publications	....do....	32	1062	1	1903	200,000.00 4,000.00	190,961.49	13,038.51
Collecting agricultural statistics	....do....	32	300	1	1903	94,200.00	94,023.27	176.73
Agricultural experiment stations ($796,000 [a])	....do....	32	301	1	1903	76,000.00	77,552.69	333.31
Amount of deposits	....do....	32	301	1	1903	[b] 1,886.00		
Nutrition investigations	....do....	32	302	1	1903	20,000.00	19,901.12	98.88
Irrigation investigations	....do....	32	302	1	1903	65,000.00	62,201.12	2,798.88
Public road inquiries	....do....	32	302	1	1903	30,000.00	29,996.13	3.87
Foreign market investigations	....do....	32	300	1	1903	6,500.00	6,140.02	359.98
Silk investigations	....do....	32	303	1	1903	10,000.00	7,133.32	2,866.68
Expenses, Bureau of Animal Industry	....do....	32	289	1	1903	1,660,000.00		
Urgent deficiency, Bureau of Animal Industry	....do....	32	1165	1	1903	500,000.00	1,444,113.05	215,886.95
Weather Bureau:								
Salaries	....do....	32	286	1	1903	165,260.00	164,927.46	332.54
Fuel, lights, and repairs	....do....	32	287	1	1903	10,000.00	9,964.65	35.35
Contingent expenses	....do....	32	287	1	1903	8,000.00	7,806.38	193.62
General expenses	....do....	32	287	1	1903	915,000.00	428,219.24 480,377.71	1,280.76 5,622.29
Meteorological observation stations	....do....	32	288	1	1903	60,000.00	59,628.24	371.76
Buildings	....do....	32	288	1	1903	50,000.00	49,467.00	533.00
Cables and land lines	....do....	32	288	1	1903	40,000.00	40,000.00	.....
Storm-warning stations, Glenhaven and South Manitou Island, Mich	....do....	32	288	1	1903	15,000.00	15,000.00	.....
Salaries, Department of Agriculture, officers and clerks	Mar. 3, 1903	32	1147	1	1904	470,080.00	458,295.90	11,784.10
Salaries, extra laborers	....do....	32	1147	1	1904	1,000.00	982.01	17.99
Bureau of Animal Industry:								
General expenses, including $1,800 for rent of building	....do....	32	1150	1	1904	1,200,000.00	1,199,410.98	589.02
To eradicate contagious diseases of animals	....do....					250,000.00	249,868.64	131.06

[a] Of this amount $720,000 was paid directly to the experiment stations from the Treasury Department.
[b] Receipts from sales of certain products of Alaska, Hawaii, and Porto Rico experiment stations.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Bureau of Plant Industry:								
Vegetable pathological investigations	Mar. 3, 1903	32	1152	1	1904	$122,000.00	$122,889.98	$0.06
Rent of building	do	32	1152	1	1904	3,000.00	2,109.96	
Vegetable pathological investigations, 1903–4	do	32	1152	1	1904	5,000.00	4,998.41	1.59
Pomological investigations	do	32	1153	1	1904	37,000.00	35,636.08	1,363.92
Botanical investigations and experiments	do	32	1153	1	1904	62,000.00	60,693.23	1,306.77
Rent of building	do	32	1153	1	1904	3,000.00	3,000.00	.....
Grass and forage plant investigations	do	32	1154	1	1904	33,800.00	34,514.48	235.52
Rent of building	do	32	1154	1	1904	1,200.00	250.00	
Experimental gardens and grounds, Department of Agriculture	do	32	1154	1	1904	25,000.00	24,984.11	15.89
Arlington Experimental Farm	do	32	1155		1904	15,000.00	14,972.99	27.01
Tea-culture investigations	do	32	1155	1	1904	10,000.00	8,701.07	1,298.93
Purchase and distribution of valuable seeds	do	32	1155	1	1904	257,000.00	257,247.74	256.26
Foreign seed and plant introduction	do	32	1155	1	1904	30,000.00	27,483.93	2,012.07
Rent of building	do	32	1156	1	1904	3,000.00	.....	3,000.00
Investigating production of domestic sugar	do	32	1156	1	1904	5,000.00	4,249.41	750.59
Bureau of Forestry:								
Forestry investigations, including $10,000 for rent of building	do	32	1156	1	1904	312,860.00	311,588.63	1,271.37
Protection of forest reserves[a]	do	.....	.....	...	.....	16,864.01	341.12	16,522.89
Bureau of Chemistry:								
Laboratory, including $5,000 for table sirup	do	32	1157	1	1904	60,500.00	60,317.39	182.61
Laboratory, table sirup, 1903–4	do	32	1157	1	1904	10,000.00	9,898.89	101.11
Bureau of Soils, including $2,000 for rent of building	do	32	1159	1	1904	170,000.00	166,286.32	3,713.68
Entomological investigations	do	32	1160	1	1904	43,500.00	39,114.76	4,385.24
Silk investigations	do	32	1160	1	1904	10,000.00	9,055.31	944.69
Entomological investigations, 1903–4	do	32	1160	1	1904	12,000.00	11,825.82	174.18
Biological investigations, including $1,000 for care of game	do	32	1160	1	1904	34,000.00	33,066.92	933.08
Publications, Department of Agriculture, Farmers' Bulletins	do	32	1161	1	1904	105,000.00	104,997.90	2.10
Artists, etc	do	32	1161	1	1904	10,000.00	9,992.49	7.51
Labor, etc	do	32	1161	1	1904	85,000.00	84,746.73	253.27
Collecting agricultural statistics	do	32	1162	1	1904	104,200.00	103,225.90	974.10
Collecting agricultural statistics, 1903–4	do	32	1162	1	1904	5,000.00	4,996.84	3.16
Foreign-market investigations	do	32	1162	1	1904	7,500.00	7,455.40	44.60
Library, Department of Agriculture	do	32	1163	1	1904	10,000.00	9,972.93	27.07
Contingent expenses, Department of Agriculture	do	32	1163	1	1904	37,000.00	36,999.77	.23
Agricultural experiment stations ($810,000[b])	do	32	1163	1	1904	40,000.00	39,997.74	2.26
Stations of Alaska	do	32	1164	1	1904	15,000.00	15,000.00	.....
Stations of Hawaii	do	32	1164	1	1904	15,000.00	15,000.00	.....
Stations of Porto Rico	do	32	1164	1	1904	15,000.00	15,000.00	.....
Farmers' institutes	do	32	1164	1	1904	5,000.00	4,838.69	161.31
Nutrition investigations	do	32	1164	1	1904	20,000.00	19,994.18	5.82
Irrigation investigations	do	32	1165	1	1904	65,000.00	64,938.65	61.35
Public road inquiries	do	32	1165	1	1904	32,000.00	31,813.00	187.00
Public road inquiries, 1903–4	do	32	1165	1	1904	3,000.00	3,000.00	.....

[a] This appropriation and amount transferred from Department of Interior.
[b] Of this amount, $720,000 is paid directly to the experiment stations from the Treasury Department.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Weather Bureau:								
Salaries	Mar. 3, 1903	32	1148	1	1904	$175,440.00	$175,098.94	$341.06
Fuel, lights, and repairs	....do....	32	1148	1	1904	6,000.00	5,981.63	18.37
Contingent expenses	....do....	32	1148	1	1904	8,000.00	7,818.52	181.48
General expenses, salaries	....do....	32	1149	1	1904	472,300.00	471,917.22	382.78
General expenses, miscellaneous	....do....	32	1149	1	1904	496,780.00	494,741.03	2,038.97
Buildings	....do....	32	1149	1	1904	50,000.00	50,000.00	.....
Cables and land lines	....do....	23	1149	1	1904	40,000.00	40,000.00	.....
Salaries, officers and clerks	Apr. 23, 1904	33	276	1	1905	481,300.00	407,998.89	10,301.11
Salaries, extra laborers	....do....	33	277	1	1905	1,000.00	971.66	28.34
Bureau of Animal Industry:								
Deficiency appropriation	....do....	33	1242	1	1905	150,000.00	1,399,227.96	772.04
General expenses, including $1,800 for rent of building	....do....	33	279	1	1905	1,250,000.00		
Animal breeding and feeding	....do....	33	281	1	1905	25,000.00	20,540.67	4,459.33
To eradicate contagious diseases of animals, 1904–5[c]	....do....	33	5	1	1905	250,000.00	248,980.79	1,019.21
Bureau of Plant Industry:								
Vegetable pathological investigations	....do....	33	281	1	1905	145,000.00	145,705.01	.....
Rent of building	....do....	33	281	1	1905	3,000.00	2,294.99	.....
Vegetable pathological investigations, 1904–5	....do....	33	281	1	1905	2,000.00	2,000.00	.....
Rent of quarters (deficiency)	....do....	33	603	1	1905	2,500.00	2,485.00	15.00
Pomological investigations[a]	....do....	33	282	1	1905	43,500.00	41,280.58	2,219.42
Botanical investigations and experiments	....do....	33	283	1	1905	64,500.00	63,914.24	585.76
Rent of building	....do....	33	283	1	1905	3,000.00	3,000.00	.....
Grass and forage plant investigations	....do....	33	283	1	1905	40,500.00	40,012.04	487.96
Rent of building	....do....	33	283	1	1905	2,000.00	1,500.00	500.00
Experimental gardens and grounds, Department of Agriculture	....do....	33	284	1	1905	25,000.00	24,725.40	274.60
Greenhouses, Department of Agriculture, 1904–5	....do....	33	284	1	1905	25,000.00	24,995.32	4.68
Arlington Experimental Farm	....do....	33	284	1	1905	20,000.00	19,838.70	161.30
Tea-culture investigations	....do....	33	284	1	1905	10,000.00	8,387.15	1,612.85
Purchase and distribution of valuable seeds[b]	....do....	33	285	1	1905	242,500.00	240,379.71	2,120.29
Foreign seed and plant introduction[b]	....do....	33	286	1	1905	40,000.00	39,687.44	312.56
Repairs to building	....do....	33	285	1	1905	7,500.00	4,000.00	3,500.00
Investigating production of domestic sugar	....do....	33	286	1	1905	7,500.00	7,222.14	277.86
Bureau of Forestry:								
Forestry investigations, including $15,500 for rent of building	....do....	33	286	1	1905	388,000.00	386,618.32	1,381.68
Protection of Forest Reserves	....do....	33	286	1	1905	50,000.00	49,025.23	974.77
Testing timbers, Louisiana Purchase Exposition, St. Louis, Mo. (deficiency act)	....do....	33	1242	1	1905	10,000.00	9,985.82	14.18
Bureau of Chemistry:								
Laboratory, including $15,000 for table sirup	....do....	33	287	1	1905	105,000.00	103,693.95	1,306.05
Laboratory, 1904–5	....do....	33	288	1	1905	15,000.00	14,716.95	283.05
Laboratory road materials	....do....	33	288	1	1905	15,000.00	14,802.99	197.01
Bureau of Soils:								
Soil investigations, including $6,000 for rent of building	....do....	33	288	1	1905	170,000.00	168,638.84	1,361.16
Entomological investigations	....do....	33	289	1	1905	70,000.00	69,124.44	875.56
Cotton boll-weevil investigations, 1904–5[c]	....do....	33	5	1	1905	250,000.00	220,685.40	29,314.60

[a] By receipts from sale of fruits and vegetables (Pomological investigations) $2,426.21
[b] By transfer from foreign to domestic seeds 4,183.54
[c] By transfer from cotton boll weevil to Bureau of Animal Industry, 1904–5 ..... 3,500.00

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Biological investigations	Apr. 23, 1904	33	290	1	1905	$33,000.00	$32,937.70	$62.30
Biological investigations, 1904–5, care of elk	....do....	33	291	1	1905	1,000.00	807.14	192.86
Publications, Department of Agriculture, Farmers' Bulletins	....do....	33	291	1	1905	105,000.00	104,885.16	114.84
Artists, etc	....do....	33	291	1	1905	15,000.00	14,635.28	364.72
Labor, etc	....do....	33	291	1	1905	89,000.00	88,985.64	14.36
Labor, etc., 1904–5	....do....	33	291	1	1905	1,000.00	430.64	569.36
Collecting agricultural statistics	....do....	33	292	1	1905	132,000.00	130,539.73	1,460.27
Foreign-market investigations	....do....	33	292	1	1905	7,500.00	6,069.72	1,430.28
Library, Department of Agriculture	....do....	33	293	1	1905	10,000.00	9,640.28	359.72
Contingent expenses, Department of Agriculture	....do....	33	293	1	1905	37,000.00	36,963.20	36.80
Agricultural experiment stations ($810,000[a])	....do....	33	293	1	1905	40,000.00	39,703.10	296.90
Stations of Alaska	....do....	33	294	1	1905	15,000.00	15,000.00	.....
Stations of Hawaii	....do....	33	294	1	1905	15,000.00	15,000.00	.....
Stations of Porto Rico	....do....	33	294	1	1905	15,000.00	15,000.00	.....
Farmers' institutes	....do....	33	294	1	1905	5,000.00	4,603.53	396.47
Nutrition investigations	....do....	33	294	1	1905	20,000.00	19,976.98	23.02
Irrigation investigations	....do....	33	294	1	1905	67,500.00	67,416.35	83.65
Public road inquiries	....do....	33	295	1	1905	35,000.00	34,319.03	680.97
Building, Department of Agriculture	....do....	32	806	1	1905	250,000.00	108,496.32	141,503.68
Weather Bureau:								
Salaries	....do....	33	277	1	1905	180,440.00	180,225.57	214.43
Fuel, lights, and repairs	....do....	33	278	1	1905	8,000.00	7,979.20	20.80
Contingent expenses	....do....	33	278	1	1905	10,000.00	9,702.60	297.40
General expenses, salaries	....do....	33	278	1	1905	492,300.00	491,725.31	574.69
General expenses, miscellaneous	....do....	33	279	1	1905	572,000.00	569,424.01	2,575.99
Buildings	....do....	33	279	1	1905	48,000.00	47,803.11	196.89
Cables and land lines	....do....	33	279	1	1905	27,000.00	26,991.09	8.91
Salaries, officers and clerks	Mar. 3, 1905	33	861	1	1906	804,970.00	783,042.64	21,927.36
Salaries, extra labor	....do....	33	861	1	1906	10,000.00	9,120.34	879.66
Bureau of Animal Industry:								
Deficiency act	Feb. 27, 1906	....	.....	...	1906	.....	.....	.....
General expenses (including $63,000 deficiency)	Mar. 3, 1905	33	864	1	1906	1,492,020.00	1,405,951.28	86,068.72
Animal breeding and feeding	....do....	33	866	1	1906	25,000.00	24,429.56	570.44
Rent of buildings	....do....	33	865	1	1906	2,500.00	1,802.00	698.00
Bureau of Plant Industry:								
Vegetable pathological investigations	....do....	33	867	1	1906	139,640.00	135,320.51	4,319.49
Rent of building	....do....	33	867	1	1906	6,000.00	3,720.00	2,280.00
Vegetable pathological investigations, 1905–6	....do....	33	868	1	1906	10,000.00	9,560.46	439.54
Grain investigations	....do....	33	868	1	1906	25,000.00	23,843.68	1,156.32
Pomological investigations	....do....	33	868	1	1906	33,640.00	33,639.62	.38
Rent of building	....do....	33	868	1	1906	2,000.00	2,000.00	.....
Botanical investigations and experiments	....do....	33	869	1	1906	60,840.00	59,338.60	1,501.40
Rent of building	....do....	33	869	1	1906	3,000.00	3,000.00	.....
Grass and forage plant investigations	....do....	33	869	1	1906	37,160.00	33,279.00	3,881.00
Rent of building	....do....	33	869	1	1906	2,500.00	2,490.00	10.00
Experimental gardens and grounds	....do....	33	870	1	1906	15,320.00	15,273.75	46.25
Experimental gardens and grounds, 1905–6	....do....	33	870	1	1906	5,000.00	4,978.00	22.00
Arlington experimental farm	....do....	33	870	1	1906	20,000.00	19,667.35	332.65
Tea-culture investigations	....do....	33	870	1	1906	8,500.00	7,944.83	555.17
Purchase and distribution of valuable seeds	....do....	33	870	1	1906	205,140.00	202,767.39	2,372.61
Foreign seed and plant introduction	....do....	33	871	1	1906	37,780.00	32,429.83	5,350.17
Investigating production of domestic sugar	....do....	33	872	1	1906	7,500.00	7,317.54	182.46

[a] Of this amount $720,000 was paid directly to the experiment stations from the Treasury Department.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Forest Service:								
General expenses, Forest Service	Mar. 3, 1905	33	872	1	1906	$768,180.00	$767,722.04	$457.96
Rent of buildings	....do....	33	873	1	1906	25,000.00	25,000.00	.....
Bureau of Chemistry:								
Laboratory, including $3,000 for table sirup	....do....	33	873	1	1906	130,920.00	128,289.99	2,630.01
Bureau of Soils:								
Soil investigations, including $4,000 for rent of building	....do....	33	875	1	1906	170,000.00	167,403.73	2,596.27
Bureau of Entomology:								
Entomological investigations, including $2,500 for moth investigations	....do....	33	876	1	1906	68,060.00	65,457.52	2,602.48
Bureau of Biological Survey:								
Biological investigations	....do....	33	877	1	1906	44,420.00	44,064.71	355.29
Division of Publications:								
Publications, Department of Agriculture, Farmers' Bulletins	....do....	33	878	1	1906	98,750.00	98,601.49	148.51
Artists, etc	....do....	33	878	1	1906	3,500.00	3,434.10	65.90
Labor, etc	....do....	33	879	1	1906	30,000.00	29,767.04	232.96
Bureau of Statistics:								
Collecting agricultural statistics	....do....	33	879	1	1906	93,900.00	90,007.12	3,892.88
Foreign market investigations	....do....	33	879	1	1906	4,900.00	4,720.13	179.87
Library, Department of Agriculture	....do....	33	880	1	1906	8,040.00	7,411.73	628.27
Contingent expenses, Department of Agriculture	....do....	33	880	1	1906	35,000.00	34,878.55	121.45
Contingent expenses, 1905–6	....do....	33	880	1	1906	2,000.00	2,000.00	.....
Agricultural experiment stations ($1,034,660)[a]	....do....	33	881	1	1906	21,660.00	20,908.90	751.10
Stations of Alaska, including $3,000 for purchase of live stock	....do....	33	881	1	1906	18,000.00	18,000.00	.....
Stations of Hawaii	....do....	33	881	1	1906	15,000.00	15,000.00	.....
Stations of Porto Rico	....do....	33	881	1	1906	15,000.00	15,000.00	.....
Farmers' institutes	....do....	33	882	1	1906	5,000.00	4,550.52	449.48
Nutrition investigations	....do....	33	882	1	1906	20,000.00	19,805.11	194.89
Irrigation investigations	....do....	33	882	1	1906	74,200.00	74,044.61	155.39
Public-road inquiries	....do....	33	882	1	1906	37,660.00	36,479.77	1,180.23
Cotton-boll weevil investigations	....do....	33	883	1	1906	190,000.00	154,671.59	35,328.41
Weather Bureau:								
Salaries	....do....	33	862	1	1906	191,430.00	190,930.72	499.28
Fuel, lights, and repairs	....do....	33	862	1	1906	10,000.00	9,926.33	73.67
Contingent expenses	....do....	33	863	1	1906	10,000.00	9,841.53	158.47
Salaries, station employees	....do....	33	863	1	1906	531,550.00	530,662.89	887.11
General expenses	....do....	33	863	1	1906	562,010.00	553,143.78	8,866.22
Buildings	....do....	33	863	1	1906	53,000.00	52,748.43	251.57
Cables and land lines	....do....	33	864	1	1906	35,000.00	34,121.31	878.69
Salaries, officers and clerks	June 30, 1906	34	670	1	1907	750,170.00	731,284.77	18,885.23
Salaries, extra labor	....do....	34	670	1	1907	7,600.00	6,430.73	1,169.27
Contingent expenses	....do....	34	692	1	1907	37,000.00	36,603.13	396.87
Library	....do....	34	691	1	1907	10,000.00	9,518.47	481.53
Bureau of Animal Industry:								
General expenses	....do....	34	673	1	1907	809,700.00	745,546.97	64,153.03
Rent of buildings	....do....	34	673	1	1907	2,500.00	2,481.00	19.00
Southern dairy work	....do....	34	674	1	1907	20,000.00	17,762.01	2,237.99
Diseases of domestic animals, Minnesota	....do....	34	674	1	1907	5,000.00	1,691.76	3,308.24
Animal breeding and feeding	....do....	34	674	1	1907	25,000.00	24,361.92	638.08
Meat inspection	....do....	34	674	1	1907	3,000,000.00	2,163,907.68	836,092.32
Eradicating cattle ticks:								
1907	....do....	34	696	1	1907	82,500.00	81,328.30	1,171.70
1907 and 1908	Mar. 4, 1907	34	1281	1	1907	25,000.00	14,188.10	10,811.90
Bureau of Plant Industry:								
General expenses	June 30, 1906	34	680	1	1907	480,406.28	470,158.84	8,801.16
Rent and repairs	....do....	34	681	1	1907	11,300.00	11,216.75	83.25
Ozark Mountain investigations	....do....	34	681	1	1907	3,553.72	4,993.44	6.56
Grain investigations	....do....	34	681	1	1907	15,000.00	14,903.23	96.77

[a] Of this amount $960,000 was paid directly to the experiment stations from the Treasury Department.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Bureau of Plant Industry—Continued.								
Improving roads	June 30, 1906	34	681	1	1907	$3,500.00	$3,474.10	$25.90
Purchase and distribution of valuable seeds	....do....	34	682	1	1907	205,140.00	201,004.98	4,135.02
Foreign seed and plant introduction	....do....	34	682	1	1907	35,781.21	33,834.64	1,946.57
Erection of building at Chico, Cal.	....do....	34	683	1	1907	1,998.79	1,998.79	(a)
Cotton boll weevil investigations:								
1907	....do....	34	695	1	1907	105,000.00	101,832.47	3,167.53
1907 and 1908	Mar. 4, 1907	34	1280	1	1907	40,000.00	39,999.63	.37
Bureau of Chemistry:								
Laboratory	June 30, 1906	34	685	1	1907	145,920.00	142,174.00	3,746.00
Enforcement of the food and drugs act	Dec. 19, 1906	34	841	1	1907	250,000.00	100,279.95	149,720.05
Bureau of Soils:								
Soils investigations	June 30, 1906	34	687	1	1907	181,000.00	179,910.62	1,089.38
Rent of buildings	....do....	34	687	1	1907	4,000.00	3,920.00	80.00
Bureau of Entomology:								
Entomological investigations	....do....	34	688	1	1907	70,000.00	69,114.27	885.73
White fly investigations	....do....	34	688	1	1907	5,000.00	4,902.34	97.66
Cotton boll weevil investigations	....do....	34	695	1	1907	85,000.00	64,873.54	20,126.46
Preventing spread of moths:								
1907	....do....	34	696	1	1907	82,500.00	81,993.24	506.76
1907 and 1908	Mar. 4, 1907	34	1281	1	1907	150,000.00	8,592.73	141,407.27
Bureau of Biological Survey:								
Biological investigations	June 30, 1906	34	688	1	1907	44,420.00	43,975.22	444.78
Division of Publications:								
Publications, Farmers' Bulletins	....do....	34	690	1	1907	98,750.00	98,601.18	148.82
Artists, etc.	....do....	34	690	1	1907	3,500.00	3,387.46	112.54
Labor, etc.	....do....	34	690	1	1907	30,000.00	29,836.21	163.79
Bureau of Statistics:								
Collecting agricultural statistics	....do....	34	691	1	1907	108,000.00	105,466.40	2,533.60
Foreign markets investigations	....do....	34	691	1	1907	4,900.00	4,852.95	47.05
Office of Experiment Stations:								
Agricultural experiment stations ($803,500 b)	....do....	34	693	1	1907	25,500.00	607,210.54	48,289.46
Farmers' institutes	....do....	34	693	1	1907	5,000.00	4,765.85	234.15
Station at Alaska, including $3,000 for purchase of live stock	....do....	34	693	1	1907	18,000.00	17,987.49	12.51
Station at Hawaii, including $5,000 for water supply	....do....	34	693	1	1907	20,000.00	19,998.75	1.25
Station at Porto Rico	....do....	34	693	1	1907	15,000.00	15,000.00	(a)
Nutrition investigations	....do....	34	694	1	1907	20,000.00	19,990.99	9.01
Irrigation investigations	....do....	34	694	1	1907	122,200.00	121,638.29	561.71
Office of Public Roads: Public road inquiries	....do....	34	694	1	1907	57,660.00	56,833.94	826.06
Weather Bureau:								
Salaries	....do....	34	671	1	1907	194,690.00	193,918.11	771.89
Fuel, lights, and repairs	....do....	34	671	1	1907	10,000.00	9,928.49	71.51
Contingent expenses	....do....	34	671	1	1907	10,000.00	9,912.56	87.44
Salaries, station employees	....do....	34	672	1	1907	541,550.00	540,702.30	847.70
General expenses	....do....	34	672	1	1907	630,000.00	616,415.03	13,584.97
Buildings	....do....	34	672	1	1907	53,000.00	51,727.28	1,272.72
Forest Service:								
Salaries, officers and clerks	June 30, 1906	34	683	1	1907	$112,860.00	$112,133.16	$726.84
General expenses	....do....	34	683	1	1907	849,640.00	849,265.94	374.06
Rent	....do....	34	685	1	1907	35,000.00	29,050.36	5,949.64
Building on Dismal River Forest Reserve	....do....	34	696	1	1907	2,500.00	2,475.22	24.78
Wichita Forest and Game Preserve	....do....	34	696	1	1907	15,000.00	14,999.00	1.00

a Exhausted.

b This includes $720,000 for state experiment stations paid through the Treasury Department. Congress also appropriated $336,000 for state experiment stations under the Adams bill to be paid through the Treasury Department. Total paid through the Treasury Department for state experiment stations, $1,056,000. Congress also appropriated in the sundry civil bill for printing and binding $300,000.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large. Vol.	Page.	Sec.	Fiscal year.	Amount appropriated.	Amount disbursed	Amount unexpended.
Forest Service—Continued.								
Survey and report on Appalachian and White Mountain watersheds, 1907 and 1908	Mar. 4, 1907	34	1281	1	1907	$25,000.00	$857.14	$24,142.86
Administration, etc., of the national forests, 1907 and 1908	do	34	1270	1	1907	125,000.00	6,213.21	118,786.79
Special appropriations:								
Pomological investigations, fund from sale of fruits and vegetables	Apr. 23, 1904	33	382	1	1905	3,744.74	3,744.64	.10
Agricultural experiment stations, fund from sale of card indexes	do	33	293	1	1905	65.15	65.15	(a)
Buildings, Department of Agriculture	Mar. 3, 1903 Mar. 3, 1905	32 33	1139 1211			250,000.00 700,000.00		
Balance available July 1, 1906						480,934.68		
Sundry civil act	June 30, 1906	34	758			300,000.00	535,594.61	245,340.07
Administration, etc., forest reserves						925,000.00	812,293.34	112,706.66
Cooperative work, forest investigations						21,410.25	16,612.05	4,798.20
Salaries, officers and clerks	Mar. 4, 1907	34	1256	1	1908	969,090.00	947,454.88	21,635.12
Salaries, extra labor	do	34	1256	1	1908	7,600.00	7,592.28	7.72
Contingent expenses	do	34	1277	1	1908	47,000.00	46,435.97	564.03
Library	do	34	1277	1	1908	12,500.00	12,498.43	1.57
Bureau of Animal Industry:								
General expenses	do	34	1259	1	1908	892,200.00	878,938.39	13,261.61
Diseases of domestic animals, Minnesota	do	34	1259	1	1908	5,000.00	2,970.01	2,029.99
Animal breeding and feeding	do	34	1260	1	1908	50,000.00	49,649.15	350.85
Meat inspection	June 30, 1906	34	674	1	1908	3,000,000.00	2,725,034.27	274,965.73
Eradicating cattle ticks: 1908	Mar. 4, 1907	34	1281	1	1908	125,000.00	122,444.15	2,555.85
1907 and 1908 (appropriated $25,000; balance July 1, 1907)	do	34	1281	1	1908	10,811.90	10,811.90	(a)
Bureau of Plant Industry:								
General expenses, 1908–9						10,000.00	9,992.61	7.39
General expenses	do	34	1266	1	1908	515,484.25	572,635.62	848.63
Rent and repairs	do	34	1267	1	1908	11,295.75	11,295.75	(a)
Grain investigations	do	34	1267	1	1908	40,000.00	39,862.20	137.80
Purchase and distribution of valuable seeds (includes $50,000, deficiency act)	do	34	1267	1	1908	252,000.00	249,864.82	2,135.18
Foreign seed and plant introduction	do	34	1267	1	1908	36,000.00	35,487.38	512.62
Cotton boll weevil investigations, 1908	do	34	1280	1	1908	110,000.00	109,513.44	486.56
Bureau of Chemistry: Laboratory	do	34	1271	1	1908	650,000.00	611,925.10	38,074.90
Bureau of Soils:								
Soil investigations	do	34	1272	1	1908	166,000.00	165,589.19	410.81
Rent of buildings	do	34	1273	1	1908	4,000.00	3,486.66	513.34
Bureau of Entomology:								
Entomological investigations	do	34	1273	1	1908	103,800.00	101,416.46	2,383.54
White fly investigations	do	34	1274	1	1908	10,000.00	9,530.04	469.96
Cotton boll weevil investigations	do	34	1280	1	1908	40,000.00	38,396.83	1,603.17
Preventing spread of moths, 1907 and 1908 (appropriated $150,000; balance July 1, 1907)	do	34	1280	1	1908	141,407.27	132,475.59	8,931.68
Bureau of Biological Survey:								
Biological investigations	do	34	1274	1	1908	44,420.00	44,261.67	158.33
Division of Publications: Publications [b]	do	34	1275	1	1908	35,000.00	34,888.63	111.37
Bureau of Statistics:								
Collecting agricultural statistics	do	34	1276	1	1908	118,000.00	117,917.44	82.56

[a] Exhausted.

[b] Congress also appropriated, in the sundry civil bill, for printing and binding $433,750.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Bureau of Statistics—Cont'd.								
Foreign markets investigations	Mar. 4,1907	34	1276	1	1908	$4,900.00	$4,705.02	$194.98
Office of Experiment Stations:								
Agricultural experiment stations ($827,000) [a]	....do....	34	1278	1	1908	30,000.00	28,341.73	1,658.27
Farmers' institutes	....do....	34	1279	1	1908	5,000.00	4,931.47	68.53
Station at Alaska	....do....	34	1278	1	1908	24,000.00	23,995.29	4.71
Station at Hawaii	....do....	34	1278	1	1908	24,000.00	23,994.94	5.06
Station at Porto Rico	....do....	34	1278	1	1908	24,000.00	24,000.00	[b]
Nutrition investigations	....do....	34	1279	1	1908	5,000.00	1,758.98	3,241.02
Irrigation investigations	....do....	34	1279	1	1908	150,000.00	149,305.43	694.57
Office of Public Roads:								
Public road inquiries	....do....	34	1280	1	1908	55,660.00	55,592.98	67.02
Rent and repairs	....do....	34	1280	1	1908	2,000.00	1,879.93	120.07
Weather Bureau:								
Salaries	....do....	34	1257	1	1908	196,990.00	196,250.16	739.84
Fuel, lights, and repairs	....do....	34	1258	1	1908	10,000.00	9,884.15	115.85
Contingent expenses	....do....	34	1258	1	1908	10,000.00	9,815.34	184.66
Salaries, station employees	....do....	34	1258	1	1908	551,550.00	550,545.99	1,004.01
General expenses	....do....	34	1258	1	1908	645,000.00	593,211.46	51,788.54
Forest Service:								
General expenses	....do....	34	1269	1	1908	1,696,800.00	1,702,007.47	1,578.17
Rent (joint resolution, Jan 7, 1908, increasing rent)	....do....	34	1270	1	1908	60,000.00	53,214.36	
Administration, etc., of National Forests, 1908	....do....	34	1270	1	1908	375,000.00	374,034.44	965.56
Survey and report on Appalachian and White Mountain watersheds, 1907 and 1908 (appropriated $25,000; balance July 1, 1907)	....do....	34	1281	1	1908	23,403.76	15,845.37	7,558.39
Administration, etc., of National Forests, 1907 and 1908 (appropriated $125,000; balance July 1, 1907)	....do....	34	1270	1	1908	118,786.79	118,786.29	.50
Special appropriations:								
Buildings, Department of Agriculture ($1,500,000)—Balance available July 1, 1909	Mar. 3,1903	32	1139	.....	.....	1,251.10	968.40	282.70
Paper tests	Mar. 3,1905	33	1211	.....	.....	10,000.00	9,974.13	25.87
Salaries, officers and clerks	May 23,1908	35	251	1	1909	879,660.00	857,714.32	21,945.68
Salaries, extra labor	....do....	35	251	1	1909	7,600.00	7,410.85	189.15
Contingent expenses	....do....	35	265	1	1909	86,200.00	79,017.79	7,182.21
Library	....do....	35	264	1	1909	15,500.00	11,535.83	3,964.17
Bureau of Animal Industry:								
General expenses	....do....	35	254	1	1909	[c]1,247,200.00	1,164,186.71	83,013.29
	Feb. 9,1909	35	616	1				
	Mar. 4,1909	35	927	1				
Animal breeding and feeding	May 23,1908	35	255	1	1909	50,000.00	44,817.57	5,182.43
Meat inspection	June 30,1906	34	674	1	1909	3,000,000.00	2,848,818.38	151,181.62
Eradicating cattle ticks—1909	May 23,1908	35	268	1	1909	225,000.00	192,528.67	32,471.33
1908 and 1909	....do....	35	268	1	1909	25,000.00	25,000.00	[b]
Bureau of Plant Industry:								
General expenses—1909	....do....	35	256	1	1909	886,266.00	810,846.00	75,420.00
1908 and 1909	....do....	35	256	1	1909	10,000.00	8,589.32	1,410.68
Purchase and distribution of valuable seeds, $205,000	....do....	35	257	1	1909	258,000.00	194,020.57	10,979.43
Foreign seed and plant introduction, $53,000							45,492.56	7,507.44
Paper tests	....do....	35	267	1	.....	10,000.00	7,472.52	2,527.48
General expenses, 1909 and 1910	Mar. 4,1909	35	1,044	1	1909	50,000.00	17,366.47	32,633.53

[a] This includes $720,000 for state experiment stations under the regular appropriation, to be paid through the Treasury Department. Congress also appropriated $432,000 as a permanent appropriation for state experiment stations under the Adams bill, to be paid through the Treasury Department. Total to be paid through the Treasury Department for state experiment stations $1,152,000.

[b] Exhausted.

[c] Including $150,000, deficiency act, February 9, 1909, and $180,000 by deficiency act, March 4, 1909.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Bureau of Chemistry: Laboratory	May 23, 1908 Feb. 9, 1909	35 35	260 616	1 1	1909	[a] $860,000.00	$612,495.42	$247,504.58
Bureau of Soils: Soil investigations	May 23, 1908	35	261	1	1909	200,000.00	190,224.94	9,775.06
Bureau of Entomology:								
Entomological investigations—								
1909	....do....	35	262	1	1909	148,800.00	139,380.22	9,419.78
1908 and 1909	....do....	35	262	1	1909	10,000.00	9,451.81	548.19
Preventing spread of moths, 1908 and 1909	....do....	35	268	1	1909	250,000.00	217,569.44	32,430.56
Bureau of Biological Survey:								
Biological investigations	....do....	35	262	1	1909	54,420.00	51,117.29	3,302.71
Division of Publications: Publications, Department of Agriculture [b]	....do....	35	263	1	1909	40,000.00	38,867.69	1,132.31
Bureau of Statistics: Collecting agricultural statistics	....do....	35	264	1	1909	125,000.00	114,028.11	10,971.89
Office of Experiment Stations:								
Agricultural experiment stations ($843,000) [c]	....do....	35	265	1	1909	30,000.00	28,518.46	1,481.54
Farmers' institutes	....do....	35	266	1	1909	10,000.00	8,359.83	1,640.17
Station at Alaska	....do.... [d]	35	266	1	1909	26,000.00	26,000.00	[d]
Station at Hawaii	....do....	35	266	1	1909	26,000.00	26,000.00	[d]
Station at Porto Rico	....do....	35	266	1	1909	26,000.00	26,000.00	[d]
Station at Island of Guam	....do....	35	266	1	1909	5,000.00	5,000.00	[d]
Nutrition investigations	....do....	35	266	1	1909	7,000.00	6,993.53	6.47
Irrigation investigations	....do....	35	266	1	1909	150,000.00	143,465.23	6,534.77
Office of Public Roads:								
Public roads inquiries	....do....	35	267	1	1909	73,000.00	67,828.09	5,171.91
Rent and repairs	....do....	35	267	1	1909	2,000.00	1,833.33	166.67
Weather Bureau:								
Salaries	....do....	35	252	1	1909	202,510.00	202,142.73	367.27
Fuel, lights, and repairs	....do....	35	252	1	1909	10,000.00	8,266.67	1,733.33
Contingent expenses	....do....	35	253	1	1909	11,000.00	9,964.55	1,035.45
Salaries, station employees	....do....	35	253	1	1909	596,750.00	585,564.89	1,185.11
General expenses	....do....	35	253	1	1909	852,000.00	496,107.93	355,892.07
Forest Service:								
Salaries, officers and clerks	....do....	35	258	1	1909	144,300.00	143,464.87	835.13
General expenses	....do....	35	259	1	1909	3,151,900.00	2,821,162.56	330,737.44
Improvement of the national forests	....do....	35	260	1	1909	600,000.00	501,903.96	98,096.04
Naval stores industry	....do....	35	267	1	1909	10,000.00	8,949.32	1,050.68
National Bison Range	....do.... Mar. 4, 1909	35 35	267 927	1 1	1909	[e] 43,000.00	219.60	42,780.40
Special appropriations:								
Pomological investigations, fund from sale of fruits and vegetables, balance July 1, 1908	Apr. 23, 1904	33	382	1	.....	768.12	768.02	.10
Buildings, Department of Agriculture ($1,500,000): Balance available on July 1, 1908	Mar. 4, 1907	34	1,364	1	.....	30,294.33	29,043.23	1,251.10
Cooperative work, forest investigations	.....	.....	.....	.....	.....	45,978.88	26,687.63	19,291.25
Refunds to depositors, excess of deposits	.....	.....	.....	.....	.....	54,172.86	40,098.73	14,074.13

[a] Including $100,000, deficiency act, February 9, 1909.
[b] Congress also appropriated in the sundry civil bill for printing and binding $460,000.
[c] This includes $720,000 for state experiment stations under the regular appropriation, to be paid through the Treasury Department. Congress also appropriated $528,000 as a permanent appropriation for state experiment stations under the Adams bill, to be paid through the Treasury Department. Total to be paid through the Treasury Department for state experiment stations, $1,248,000.
[d] Exhausted.
[e] Including $3,000, deficiency act, March 4, 1909.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Subappropriations.	Transfer of funds.[a]	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.						
Salaries, Department of Agriculture (not including Forest Service and Weather Bureau)	Mar. 4, 1909	35	1039	2	1910			$1,066,360.00	$1,042,656.04	$23,703.96
Officers and clerks	....do....	35	1039	2	1910	$1,058,760			1,035,357.00	23,403.00
Extra labor	....do....	35	1040	2	1910	7,600			7,299.04	300.96
Contingent expenses, Department of Agriculture	....do....	35	1054	2	1910			80,000.00	70,360.29	9,639.71
Library, Department of Agriculture	....do....	35	1054	2	1910			16,500.00	11,915.02	4,584.98
Paper tests, 1910	....do....	35	1057	2	1910			10,000.00	9,829.16	170.84
Allotted to Bureau of Plant Industry						5,000	$439.25		439.25	
Allotted to Forest Service						5,000	9,560.75		9,389.91	170.84
Buildings, Department of Agriculture ($1,500,000), balance available July 1, 1909	{Mar. 3, 1903 Mar. 4, 1907	32 34	1139} 1364	1	1910			1,251.10	968.40	282.70
Paper tests ($10,000), balance available July 1, 1909	Mar. 23, 1908	35	267	1	1910			2,527.48	2,437.36	90.12
BUREAU OF ANIMAL INDUSTRY.										
General expenses, Bureau of Animal Industry	Mar. 4, 1909	35	1042	2	1910			1,263,760.00	1,082,152.75	181,607.25
Inspection and quarantine	....do....	35	1043	2	1910	625,000			564,040.67	60,959.33
Eradicating cattle ticks	....do....	35	1043	2	1910	250,000			225,605.51	24,394.49
Dairy industry	....do....	35	1043	2	1910	149,000			103,290.98	45,709.02
Animal husbandry	....do....	35	1043	2	1910	43,000			26,120.67	16,879.33
Diseases of animals	....do....	35	1043	2	1910	109,000			92,448.68	16,551.32
Purchase of land for experiment station	....do....	35	1043	2	1910	25,000			25,000.00	
Administrative expenses	....do....	35	1043	2	1910	62,760			45,646.24	17,113.76
Cooperative experiments in animal feeding and breeding	May 23, 1908	35	255	1	1910			50,000.00	40,156.32	9,843.68
Meat inspection, Bureau of Animal Industry (permanent appropriation)	June 30, 1906	34	674	1	1910			3,000,000.00	2,721,505.48	278,494.52
BUREAU OF PLANT INDUSTRY.										
General expenses, Bureau of Plant Industry, 1909–10 (appropriated $50,000), balance available July 1, 1909	Mar. 4, 1909	35	1045	2	1910			32,633.53	32,498.50	135.03
General expenses, Bureau of Plant Industry, 1910	....do....	35	1044	2	1910			1,130,796.00	982,228.81	148,567.19
Pathological laboratory	....do....	35	1044	2	1910	22,470			20,404.97	2,065.03
Fruit diseases	....do....	35	1044	2	1910	34,700			30,096.96	4,603.04
Forest pathology	....do....	35	1044	2	1910	17,340	16,540.00		15,481.01	1,058.99
Cotton and truck diseases	....do....	35	1044	2	1910	13,060			11,948.44	1,111.56
Crop physiology	....do....	35	1044	2	1910	27,290	26,025.00 CM		24,639.06	1,385.94
Bacteriology and nutrition	....do....	35	1044	2	1910	25,070			20,212.54	4,857.46
Crop acclimatization	....do....	35	1045	2	1910	17,990			16,831.74	1,158.26
Drug and other plants	....do....	35	1045	2	1910	43,420	44,820.00 B		40,507.81	4,312.19
Crop technology	....do....	35	1045	2	1910	13,030			10,002.93	3,027.07

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Cotton standardization	do	35	1045	2	1910	12,250			9,286.77	2,963.23
Grain standardization	do	35	1045	2	1910	52,440			42,904.39	9,535.61
Physical investigations	do	35	1045	2	1910	15,510			13,553.75	1,956.25
Special seeds and plants	do	35	1045	2	1910	11,550			9,251.06	2,298.94
Seed testing laboratories	do	35	1045	2	1910	25,840	26,040.00 Q		24,489.56	1,550.44
Grain investigations	do	35	1045	2	1910	63,910	64,830.00 AR		59,441.35	5,388.65
Tobacco investigations	do	35	1045	2	1910	23,180			19,326.49	3,853.51
Cotton breeding	do	35	1045	2	1910	18,130	16,730.00 B		15,387.83	1,342.17
General plant breeding	do	35	1045	2	1910	14,840			11,173.51	3,666.49
Paper plant investigations	do	35	1045	2	1910	10,000			7,602.31	2,397.69
Alkali and drought resistant plants	do	35	1045	2	1910	17,380			15,886.54	1,663.46
Sugar plant investigations	do	35	1045	2	1910	24,300			21,638.64	2,661.36
Taxonomic and range investigations	do	35	1045	2	1910	18,250			16,906.11	1,343.89
Farm management	do	35	1045	2	1910	133,000	32,270.00 PQ		103,980.13	28,289.87
Farmers' cooperative demonstration work	do	35	1045	2	1910	175,000			157,119.90	17,880.10
Dry-land agriculture	do	35	1045	2	1910	31,760			27,474.91	4,285.09
Western agricultural extension	do	35	1045	2	1910	76,680			68,181.74	8,498.26
Pomological investigations	do	35	1046	2	1910	71,360	72,625.00 CM		59,365.34	13,259.66
Experimental gardens and grounds	do	35	1046	2	1910	19,230	21,030.00 D		20,536.90	493.10
Arlington farm and horticulture	do	35	1046	2	1910	38,470	37,200.00 DP		32,869.19	4,330.81
Florida subtropical garden	do	35	1046	2	1910	5,100			4,058.04	1,041.96
South Texas garden	do	35	1046	2	1910	9,100			8,697.31	402.69
Administrative and miscellaneous	do	35	1046	2	1910	48,976	48,856.00 R		42,991.49	5,864.51
Purchase and distribution of valuable seeds	do	35	1047	2	1910			317,960.00	294,875.53	23,084.47
Congressional seed distribution	do	35	1047	2	1910	262,320			243,913.82	18,406.18
Forage crop investigations	do	35	1047	2	1910	10,000			8,841.92	1,158.08
Foreign seed and plant introduction	do	35	1047	2	1910	45,640			42,119.79	3,520.21
BUREAU OF CHEMISTRY.										
General expenses, Bureau of Chemistry (deficiency act, Feb. 25, 1910, $50,000)	do	35	1049	2	1910			855,000.00	696,393.12	158,606.88
Laboratory, miscellaneous expenses	do	35	1049	2	1910	30,000			21,827.30	8,172.70
Laboratory, transportation	do	35	1049	2	1910	6,300			3,209.57	3,090.43
Laboratory, salaries and rent	do	35	1049	2	1910	76,240			64,494.37	11,745.63
Laboratory, American food products	do	35	1049	2	1910	5,000			4,968.75	31.25
Food and drugs act, salaries in Washington	do	35	1049	2	1910	200,000	185,000.00 G		169,700.43	15,299.57
Food and drugs act, salaries out of Washington ($266,460)	do	35	1049	2	1910	226,460	GN		217,562.24	8,897.76
Food and drugs act, miscellaneous expenses ($136,000)	do	35	1049	2	1910	120,000			89,523.13	30,476.87
Deficiency act, miscellaneous expenses						27,000			706.96	26,293.04
Food and drugs act, transportation ($85,000)	Mar 4, 1909	35	1049	2	1910	81,000			55,045.04	25,954.96
Deficiency act, witness fees						23,000			2,959.33	20,040.67
Allotted to Referee Board:										
Food and drugs act, salaries out of Washington	Mar. 4, 1909	35	1049	2	1910	40,000	55,000.00 N		49,868.75	5,131.25
Food and drugs act, miscellaneous expenses	do	35	1049	2	1910	16,000			15,034.94	965.06
Food and drugs act, transportation	do	35	1049	2	1910	4,000			1,492.31	2,507.69

a NOTE.—And not to exceed 10 per cent of the foregoing amounts for the miscellaneous expenses of the work of any Bureau, Division, or Office herein provided for shall be available interchangeably for expenditure on the objects included within the general expenses of such Bureau, Division, or Office, but no more than 10 per cent shall be added to any one item of appropriation except in cases of extraordinary emergency, and then only upon the written order of the Secretary of Agriculture.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Subappropriations.	Transfer of funds.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.						
BUREAU OF SOILS.										
General expenses, Bureau of Soils	Mar. 4, 1909	35	1050	2	1910			$197,360.00	$189,755.77	$7,604.23
Soil laboratory investigations	do	35	1050	2	1910	$48,000	$48,500.00 J		48,185.46	314.54
Soil water investigations	do	35	1050	2	1910	5,000	4,500.00 J		3,920.54	579.46
Soil survey	do	35	1050	2	1910	137,360			131,163.12	6,196.88
Administrative expenses	do	35	1050	2	1910	7,000			6,486.65	513.35
BUREAU OF ENTOMOLOGY.										
General expenses, Bureau of Entomology	do	35	1050	2	1910			198,400.00	177,971.47	20,428.53
Deciduous fruit insects	do	35	1050	2	1910	46,600	43,600.00 E		37,843.80	5,756.20
Cereal and forage insects	do	35	1050	2	1910	21,000	22,500.00 E		20,309.54	2,190.46
Southern field crop insects	do	35	1050	2	1910	42,000			37,993.38	4,006.62
Forest insects	do	35	1050	2	1910	12,000	13,500.00 E		12,619.30	880.70
Truck crop and stored product insects	do	35	1050	2	1910	16,250			15,031.28	1,218.72
Bee culture	do	35	1050	2	1910	10,000			9,574.87	425.13
Citrus fruit insects	do	35	1051	2	1910	16,500			14,359.48	2,140.52
Miscellaneous insects	do	35	1051	2	1910	34,050			30,239.82	3,810.18
Preventing spread of moths, Bureau of Entomology	do	35	1051	2	1910			300,000.00	246,361.94	53,638.06
BUREAU OF BIOLOGICAL SURVEY.										
General expenses, Bureau of Biological Survey	do	35	1051	2	1910			74,420.00	63,449.01	10,970.99
Game preservation	do	35	1051	2	1910	9,420			6,804.24	2,615.76
Maintenance of mammal and bird reservations	do	35	1051	2	1910	7,000			5,293.68	1,706.32
Food habits of birds and mammals	do	35	1051	2	1910	25,000			22,029.19	2,970.81
Biological investigations	do	35	1051	2	1910	18,000			16,340.47	1,659.53
Administrative expenses	do	35	1052	2	1910	15,000			12,981.43	2,018.57
DIVISION OF PUBLICATIONS.										
General expenses, Division of Publications a	do	35	1053	2	1910			33,000.00	29,622.88	3,377.12
Rent in Washington	do	35	1053	2	1910	5,000			4,583.33	416.67
Labor-saving machinery, etc	do	35	1053	2	1910	5,000			4,958.95	41.05
Stationery and materials	do	35	1053	2	1910	11,500	12,500.00 M		11,349.21	1,150.79
Furniture and fixtures	do	35	1053	2	1910	1,000			855.54	144.46
Photographic equipment	do	35	1053	2	1910	5,000			4,659.61	340.39
Gas, electricity, etc	do	35	1053	2	1910	1,500			962.87	537.13
Wagons, horses, etc	do	35	1053	2	1910	1,000	1,075.00 S		987.28	87.72
Miscellaneous expenses	do	35	1053	2	1910	3,000	1,925.00 MS		1,266.09	658.91

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BUREAU OF STATISTICS.										
General expenses, Bureau of Statistics	do	35	1053	2	1910			117,060.00	100,440.51	16,619.49
Administrative expenses	do	35	1054	2	1910	25,860	23,360.00 K		18,840.65	4,519.35
Special field agents	do	35	1054	2	1910	56,000			49,051.64	6,948.36
State statistical agents	do	35	1054	2	1910	30,200	32,700.00 K		28,430.29	4,269.71
Special investigations	do	35	1054	2	1910	2,500			1,839.48	660.52
Cost production farm products	do	35	1054	2	1910	2,500			2,278.45	221.55
OFFICE OF EXPERIMENT STATIONS.										
Agricultural experiment stations ($863,800) [b]	do	35	1055	2	1910			143,800.00	135,444.65	8,355.35
Agricultural experiment stations	do	35	1055	2	1910	34,800			33,310.79	1,489.21
Farmers' institutes	do	35	1055	2	1910	10,000			9,439.89	560.11
Station at Alaska	do	35	1055	2	1910	28,000			26,800.00	1,200.00
Station at Hawaii	do	35	1055	2	1910	28,000			28,000.00	
Station at Porto Rico	do	35	1055	2	1910	28,000			28,000.00	
Station at Island of Guam	do	35	1055	2	1910	15,000			9,893.97	5,106.03
Nutrition investigations	do	35	1056	2	1910			10,000.00	7,995.97	2,004.03
Irrigation investigations	do	35	1056	2	1910			75,000.00	68,375.74	6,624.26
Drainage investigations	do	35	1056	2	1910			81,160.00	70,958.93	10,201.07
OFFICE OF PUBLIC ROADS.										
General expenses, Office of Public Roads	do	35	1056	2	1910			100,000.00	80,186.49	19,813.51
Road management	do	35	1056	2	1910	18,000			16,487.05	1,512.95
Investigating road building and maintenance	do	35	1056	2	1910	34,000			29,336.79	4,663.21
Road material	do	35	1057	2	1910	25,000			19,173.00	5,827.00
Reports of investigations	do	35	1057	2	1910	23,000			15,189.65	7,810.35
Total for main Department exclusive of Weather Bureau and Forest Service								9,156,958.11	8,158,560.05	998,428.06
WEATHER BUREAU.										
Salaries, Weather Bureau	Mar. 4,1909	35	1040	2	1910			205,310.00	204,560.91	749.09
Contingent expenses, Weather Bureau	do	35	1041	2	1910			25,000.00	22,776.08	2,223.92
General expenses, Weather Bureau	do	35	1041	2	1910			1,277,950.00	1,098,308.95	179,641.05
Station salaries	do	35	1041	2	1910	620,750			615,794.73	4,955.27
Miscellaneous expenses	do	35	1041	2	1910	91,000	91,500.00 O		71,386.10	20,113.90
Instruments, etc	do	35	1041	2	1910	30,000	31,900.00 LO		26,655.35	5,244.65
Rents and repairs	do	35	1041	2	1910	80,000	83,500.00 IL		63,395.65	20,104.35
Traveling expenses	do	35	1041	2	1910	22,000	20,000.00 L		17,671.20	2,328.80
Telephoning and telegraphing	do	35	1041	2	1910	260,000	269,000.00 HI		179,379.82	89,620.18
Line and cable repairs	do	35	1041	2	1910	4,200	3,800.00 H		2,753.82	1,046.18
Investigations and substations	do	35	1041	2	1910	125,000	112,500.00 IO		78,182.46	34,317.54
Printing office	do	35	1041	2	1910	45,000			43,089.82	1,910.18
Total for Weather Bureau								1,508,260.00	1,325,645.94	182,614.06

[a] Congress also appropriated in the sundry civil bill for printing and binding, $460,000.

[b] This includes $720,000 for state experiment stations under the regular appropriation, to be paid through the Treasury Department. Congress also appropriated $624,000 as a permanent appropriation for state experiment stations under the Adams bill to be paid through the Treasury Department. Total to be paid through the Treasury Department for state experiment stations, $1,344,000.

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Subappropriations.	Transfer of funds.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.						
FOREST SERVICE.										
Salaries, Department of Agriculture, officers and clerks	Mar. 4, 1909	35	1047	2	1910			$60,200.00	$59,455.90	$744.10
General expenses, Forest Service	do	35	1047	2	1910			3,986,000.00	3,575,394.21	410,605.79
Improvement of the national forests	do	35	1048	2	1910			600,000.00	537,101.27	62,898.73
National bison range (appropriated $43,000), balance available July 1, 1909 (deficiency act Feb. 25, 1910, $7,700)	May 23, 1908 Mar. 4, 1909	35 35	267 927	1 1	1909 1909			50,480.40 42,780.40	47,391.22	3,089.18
Naval stores industry ($10,000), balance available July 1, 1909	May 23, 1908	35	267	1	1909			1,050.68	1,046.13	4.55
Total for (regular) Forest Service								4,697,731.08	4,220,388.73	477,342.35
Total of all regular and special appropriations for entire Department								15,362,979.19	13,704,594.72	1,658,384.47
Refunds to depositors, excess of deposits								59,689.37	48,966.86	10,722.51
Cooperative work, forest investigations								47,965.60	40,670.39	7,295.21
Grand total								15,470,634.16	13,794,231.97	1,676,402.19

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Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture, etc.—Continued.

RECAPITULATION.

Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
1839...	$1,000.00	$1,000.00	.....	1876..	$249,120.00	$198,843.64	$50,276.36
1840...	.....	.....	.....	1877..	194,686.96	188,206.19	6,480.77
1841...	.....	.....	.....	1878..	198,640.00	197,634.94	1,005.06
1842...	1,000.00	1,000.00	.....	1879..	206,400.00	206,360.00	40.00
1843...	.....	.....	.....	1880..	199,500.00	198,361.72	1,138.28
1844...	2,000.00	2,000.00	.....	1881..	275,460.31	267,608.84	[b] 7,851.47
1845...	2,000.00	2,000.00	.....	1882..	363,011.05	354,482.39	[c] 8,528.66
1846...	3,000.00	3,000.00	.....	1883..	456,396.11	438,941.72	[d] 17,454.39
1847...	3,000.00	3,000.00	.....	1884..	[a] 416,641.13	413,618.09	3,023.04
1848...	4,500.00	4,500.00	.....	1885..	[a] 655,930.25	558,934.89	[e] 96,995.36
1849...	3,500.00	3,500.00	.....	1886..	[a] 677,973.22	519,196.11	158,777.11
1850...	5,500.00	5,500.00	.....	1887..	[a] 657,641.81	628,287.14	29,354.67
1851...	5,500.00	5,500.00	.....	1888 [f]	1,027,219.06	1,011,282.62	15,936.44
1852...	5,000.00	5,000.00	.....	1889..	[a] 1,134,480.60	1,033,590.22	[g] 100,890.38
1853...	5,000.00	5,000.00	.....	1890..	[a] 1,170,139.11	971,823.62	[h] 198,315.49
1854...	10,000.00	10,000.00	.....	1891..	[a] 1,372,049.21	1,266,277.36	105,771.85
1855...	[a] 50,000.00	50,000.00	.....	1892..	[a] 2,303,655.75	2,253,262.29	50,393.46
1856...	30,000.00	30,000.00	.....	1893..	2,540,060.72	2,355,430.25	184,630.47
1857...	75,000.00	75,000.00	.....	1894..	2,603,855.58	1,977,469.28	[i] 626,386.30
1858...	63,500.00	63,157.25	$342.75	1895..	[i] 2,506,915.00	2,021,030.38	485,884.62
1859...	60,000.00	60,000.00	.....	1896..	2,584,013.22	2,094,916.42	489,096.80
1860...	40,000.00	40,000.00	.....	1897..	2,448,763.53	2,348,512.98	100,250.55
1861...	60,000.00	60,000.00	.....	1898..	2,467,902.00	2,425,510.44	42,391.56
1862...	64,000.00	63,704.21	295.79	1899..	2,829,702.00	2,827,795.65	28,899.27
1863...	80,000.00	80,000.00	.....	1900..	3,006,022.00	2,947,603.42	58,418.58
1864...	199,770.60	189,270.00	10,500.00	1901..	3,304,265.97	3,239,137.39	65,128.58
1865...	112,304.05	112,196.55	107.50	1902..	3,922,780.51	3,902,675.79	20,104.72
1866...	167,787.82	167,787.82	.....	1903..	5,015,846.00	4,734,230.84	281,615.16
1867...	199,100.00	199,100.00	.....	1904..	5,025,024.01	4,969,311.64	55,712.37
1868...	279,020.00	277,094.34	1,925.66	1905..	5,894,540.00	5,820,204.00	74,336.00
1869...	172,593.00	172,593.00	.....	1906..	6,225,690.00	6,029,510.02	196,179.98
1870...	156,440.00	151,596.93	4,843.07	1907..	9,505,484.74	9,025,318.93	1,200,165.81
1871...	[a] 188,180.00	186,876.81	1,303.19	1908..	11,487,950.82	11,045,412.19	442,538.63
1872...	197,070.00	195,977.25	1,092.75	1909 [j]	14,536,320.19	12,902,295.64	1,634,024.55
1873...	202,440.00	201,321.22	1,118.78	1910 [j]	15,470,634.16	13,794,231.97	1,676,402.19
1874...	257,690.00	233,765.78	23,924.22				
1875...	337,380.00	321,079.83	16,300.17	Total.	[k] 115,288,790.39	[l] 106,845,641.46	[m] 9,248,910.58

[a] Including deficiency appropriation.

[b] Includes $1,646.45 of the appropriation for reclamation of arid lands, carried to the fiscal year 1882.

[c] Includes $85.26 of the appropriation for reclamation of arid lands and $3,530.85 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1883.

[d] Includes $7,656.13 of the appropriation for reclamation of arid lands, carried to the fiscal year 1884.

[e] Includes $93,192.27 of the appropriation for Bureau of Animal Industry and $2,970.82 of the appropriation for quarantine stations, carried to the fiscal year 1886.

[f] For the fiscal year 1888, including the sum of $8,000 appropriated for deficiencies in the appropriation for experiments in the manufacture of sugar for the fiscal years 1887 and 1888, of which $7,927.50 was disbursed and $72.50 remained unexpended.

[g] Includes $12,923.25 of the appropriation for botanical investigations and $58,364.76 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1890.

[h] Includes $188,974.69 of the appropriation for Bureau of Animal Industry, carried to the fiscal year 1891.

[i] Includes $7,891.94 for statutory salaries of the year 1894.

[j] For the years 1909 and 1910 the figures given represent payments made to close of June 30, 1910, the accounts for those years being still open at the date of this revision.

[k] This total is the amount actually appropriated for the various fiscal years, with the exception of $37,604.70 appropriated July 13, 1868, to cover a number of expenditures made in previous years. It does not include an aggregate sum of $369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)

[l] Does not include $37,604.70 which was disbursed during several years, and covered by an appropriation of like amount, made July 13, 1868. (See note [k].)

[m] Does not include an aggregate sum of $369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)

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REPORT OF THE EDITOR.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF PUBLICATIONS,
Washington, D. C., October 1, 1910.

SIR: I have the honor to submit herewith a report of the operations of the Division of Publications for the fiscal year ended June 30, 1910, some references to the work in contemplation for 1911, and a few recommendations in regard to the year 1912.

Respectfully,

JOS. A. ARNOLD,
Editor and Chief.

Hon. JAMES WILSON,
Secretary of Agriculture.

WORK OF THE YEAR.

The work consisted of editing, indexing, illustrating, and distributing the 1,983 different publications and documents of the Department, of which 25,190,469 copies were issued. This is an increase of 46⅔ per cent in the number of publications issued, and an increase of 41 per cent in the number of copies distributed, over the preceding year. These results were accomplished with a saving of $19,000 in printing and without any increase in salaries.

The number of employees on the rolls June 30, 1910, was 194. Of these, 11 were employed in the office of the Chief of the Division, 12 in the Editorial Office, 10 in indexing, 18 in drafting and photographic work, and 143 in the distribution of documents. All of the officials and employees of the Division are on the statutory roll, and assignments are made from time to time to such portions of the work as may require additional assistance to meet the exigencies of the service. The volume of work has been greater than in any preceding year, and has been performed with cheerfulness and efficiency, although many times the force has been taxed to its utmost capacity and lengthened hours of service were imperative.

The following is a comparative statement of the appropriations for the fiscal years 1907, 1908, 1909, and 1910:

Appropriations for the Division of Publications for the fiscal years 1907–1910.

Appropriation.	1907.	1908.	1909.	1910.
Statutory roll of the Division	$116,270	$126,550	$139,710	[a] $173,450
General printing fund	[b] 373,750	[b] 408,750	[b] 435,000	[b] 435,000
General expenses of the Division	33,500	35,000	40,000	33,000
Total	523,520	570,300	614,710	641,450

[a] Increase due to transfer of all employees to statutory roll.
[b] Exclusive of $25,000 for Weather Bureau.

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SUMMARY OF RESULTS.

During the year 25,190,469 copies of publications were issued by the Department. Of these, 24,530,919 were issued through this Division and 659,550 were issued through the Weather Bureau. Of the total number 17,685,819 were new and 7,504,650 were reprints of earlier publications. Of the more than 25,000,000 copies of publications noted above, 9,337,500 were Farmers' Bulletins and 15,852,969 were miscellaneous publications, including reports, bulletins, circulars, separates, etc. Of these miscellaneous publications 14,770,819 were new and 1,082,150 were earlier publications reissued. Of the Farmers' Bulletins 2,915,000 were new and 6,422,500 were reprints.

WEATHER BUREAU PUBLICATIONS.

Of the funds appropriated for the Department's printing and binding, Congress allots a specific sum for the publications of the Weather Bureau. These publications do not pass through this Division as do other publications of the Department. They are printed either at the Weather Bureau or at the Government Printing Office, are handled and stored at the Bureau, and distributed therefrom.

OCEAN CHARTS.—The Weather Bureau has continued the issue of meteorological charts of the oceans, printed in colors and 21 by 28 inches in size. A chart for the North Atlantic is issued monthly in editions of 5,300 copies; one for the North Pacific, monthly, in editions of 3,100 copies. A chart is issued quarterly for the South Atlantic and South Pacific in editions of 2,600 and 2,100, respectively. In addition to these charts there have been published during the past year charts for Alaska and the Indian Ocean to the amount of 20,000 copies.

CLIMATOLOGICAL REPORTS.—On June 30, 1909, the publication of the section Climatological Reports was discontinued at 44 section centers and in their place there is now published at the central office of the Weather Bureau a Climatological Report or Summary for the 12 drainage districts of the United States. These reports are issued monthly for each district and the edition has now reached 13,500 copies.

WEATHER MAPS AND BULLETINS.—In addition to the publications issued from the central office, there is a large output of Weather Maps, Weather Bulletins, and local Forecast Cards from the Weather Bureau stations located in all parts of the United States. However, during 1910, arrangements have been made whereby daily newspapers in 50 cities are printing maps bearing meteorological data and local forecasts, together with descriptive matter. The result has been a decrease in the number of maps published at stations from 10½ millions in 1909, to about 6 millions in 1910.

Fifty-nine stations issue weather maps and bulletins; seven have printing outfits and others use duplicating processes. The station map is a sheet 11 by 16 inches and the subscription price is 20 cents a month or $2 a year. Weather Bureau stations issue Forecast Cards to the amount of 21 millions annually and disseminate local climatological data.

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PRESS LISTS.

This Division maintains a list of agricultural and other newspapers and periodicals to which are sent copies of all publications issued by the Department in editions permitting such distribution, and a smaller list of Washington correspondents, to which copies of practically every document are mailed promptly upon issue.

Notices of important work done by the Department which may be of public interest are prepared in this Division and, with the approval of the Secretary, are distributed to the press. The number of press notices sent out during the last fiscal year was 126, and the total number of mimeograph copies aggregated 124,850. Thus the information acquired by the Department is given a wider dissemination than is possible by the distribution of its publications, which can not always be issued in editions large enough to supply the demand.

AVOIDANCE OF DUPLICATION IN DISTRIBUTION OF DOCUMENTS.

During the year it was ascertained that 184 libraries on various lists maintained in the Department were also receiving through the Superintendent of Documents, who, by provision of law, has 565 copies of every document printed for distribution to Government depositories, copies of all publications issued by the Department, and the addresses of these libraries were removed from the Department's mailing list, resulting in an aggregate saving of more than 220,000 copies of various publications, which number therefore became available for general distribution. The effort of the Division as a part of its economical management of the printing fund is to prevent any duplication in the distribution of the Department's documents, and therefore from time to time, when discovered, such addresses are removed from all but one of the lists on which they may occur.

Additional measures for the prevention of duplication in the distribution of publications have been inaugurated, involving changes in the policy with regard to reprints and individual lists in accordance with the instructions of the Secretary, under which this Division was authorized May 30, 1910—

1. To discontinue the furnishing of publications to Bureaus, Divisions, and Offices for redistribution by them, it being the policy to restrict all distribution and mailing of publications to the Division of Publications in accordance with the provisions of section 92 of the act of January 12, 1895. All letters received by a Bureau, Division, or Office which are simply requests for publications are to be referred to this office for attention and reply; all letters of a general character which would require an expert opinion to satisfactorily answer are, by direction of the Secretary, to be referred to the Bureau, Division, or Office to whose work it relates, where the letter may be answered, and, if necessary to forward publications, an order for the same should be made on this Office for the mailing of the documents. Each Bureau, Division, and Office will, as heretofore, receive not exceeding 200 copies of each of its publications, including 100 for the author, which are for office use and not for miscellaneous distribution.

2. All recommendations for reprints of publications shall be made by the Division of Publications and not by the various Bureaus, Divisions, and Offices from which the publications emanated, as the

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Division of Publications is aware of the demand for publications because the requests—that is to say, the letters—are received by that office. The Secretary will decide whether reprints should be ordered, how many copies, and how long such reprints shall continue, it being the policy to reprint and distribute those for which there is the greatest demand.

3. The printing of individual lists of publications of Bureaus, Divisions, and Offices is to be discontinued, it being the Secretary's idea that the general lists prepared by this Division and those that are furnished by the Superintendent of Documents will suffice for the use of the Department. All such lists are to be distributed only upon request and by this Division.

BRANCH PRINTING OFFICE.

For many years, up to November 20, 1909, a branch of the Government Printing Office was maintained in the basement of the Department building for the purpose of printing blanks, letter heads, labels, circular letters, and other miscellaneous job work for the Department, and this office was from January 12, 1895, to the date above mentioned, under the immediate supervision of the Chief of the Division of Publications. On the date mentioned, however, the office was abolished, consent thereto having been given by the Secretary, upon the assurance of the Public Printer that the work could be more economically done in the main office. Although some inconvenience has resulted, there has been no serious interruption to the public business, and economy has resulted both in the work of this Division and that of the Printing Office. The Department officials have become accustomed to the change, understand that more time is required to secure the printing of blanks, etc., and are cheerfully cooperating with this Division in its efforts to give satisfactory service under the changed conditions.

FARMERS' BULLETINS.

The appropriation for Farmers' Bulletins was the same as for the year 1909, namely, $125,000, with which 9,337,500 copies were procured from the Government Printing Office, while 7,755,000 copies were secured with the preceding year's appropriation. The cost per copy for the year 1910 was 1⅓ cents, as compared with 1⅛ cents per copy for the year 1909. The increase in the number of bulletins procured with the appropriation is due in a large measure to the decision to reduce the size of the bulletins whenever possible. The manuscripts submitted by the Bureaus have been carefully edited, all extraneous matter being pruned, the illustrations limited to actual requirements, and many of the bulletins reduced from 32 to 48 pages to 16 to 24 pages. The Farmers' Bulletin subseries known as Experiment Station Work contains fifty-seven numbers, each number comprising from six to a dozen short, condensed summaries of work done in one or more of the state agricultural experiment stations, and they form a library on approximately 500 subjects of interest to practical agriculturists, presented in a comprehensive and intelligible way. During recent years this series has increased in popularity, and there is every evidence that the farmers generally are beginning to appreciate their value.

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The following table shows the output of Farmers' Bulletins during the past four years and the expenditures therefor:

Output of Farmers' Bulletins and the cost for the fiscal years 1907, 1908, 1909, and 1910.

Fiscal year.	Fund drawn upon.	Number issued.	Number of copies.	Cost.
1907	Farmers' Bulletin fund	235	6,469,000	$98,601.17
1908	do	252	6,574,500	98,601.49
1909	do	271	7,755,000	122,475.48
1910	do	299	9,337,500	126,579.37

GROWTH OF FARMERS' BULLETINS AND CONGRESSIONAL DISTRIBUTION.

The following table shows the growth of Farmers' Bulletins during the past twenty-one years, together with the growth and extent of the congressional distribution:

Growth of the Farmers' Bulletin series during twenty-one years, with congressional distribution.

Year.	New bulletins issued.	Copies issued.	Copies distributed by Congressmen.	Year.	New bulletins issued.	Copies issued.	Copies distributed by Congressmen.
1890–1893	12	540,000	.....	1903	22	6,602,000	3,954,976
1894	5	278,500	.....	1904	25	6,435,000	4,895,556
1895	11	1,567,000	885,770	1905	24	5,925,500	4,782,643
1896	13	1,891,000	1,316,695	1906	33	6,568,000	5,279,476
1897	16	2,387,000	1,967,237	1907	42	6,469,000	3,484,713
1898	21	2,170,000	1,580,065	1908	26	6,574,500	3,928,437
1899	22	2,437,000	1,101,985	1909	34	7,755,000	3,960,642
1900	18	2,360,000	1,666,909	1910	45	9,337,500	6,449,589
1901	14	3,345,000	2,195,010				
1902	23	6,150,000	4,289,126	Total	406	78,792,000	51,738,829

During the year 45 new Farmers' Bulletins were issued. The following table shows the number of the bulletin, the title, and the number of copies of each issued:

New Farmers' Bulletins issued during the fiscal year 1910.

Bulletin No.	Title of bulletin.	Total number of copies.
362	Conditions Affecting the Value of Market Hay	60,000
363	The Use of Milk as Food	55,000
364	A Profitable Cotton Farm	45,000
365	Farm Management in Northern Potato-growing Sections	60,000
366	Experiment Station Work—LII	40,000
367	Lightning and Lightning Conductors	30,000
368	The Eradication of Bindweed, or Wild Morning-glory	40,000
369	How to Destroy Rats	60,000
370	Replanning a Farm for Profit	85,000
371	Drainage of Irrigated Lands	35,000
372	Soy Beans	55,000
373	Irrigation of Alfalfa	50,000
374	Experiment Station Work—LIII	40,000
375	Care of Food in the Home	190,000
376	Game Laws for 1909	60,000
377	Harmfulness of Headache Mixtures	55,000
378	Methods of Exterminating the Texas-fever Tick	85,000
379	Hog Cholera	95,000
380	The Loco-weed Disease	35,000

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New Farmers' Bulletins issued during the fiscal year 1910—Continued.

Bulletin No.	Title of bulletin.	Total number of copies.
381	Experiment Station Work—LIV	30,000
382	The Adulteration of Forage-plant Seeds	65,000
383	How to Destroy English Sparrows	45,000
384	Experiment Station Work—LV	30,000
385	Boys' and Girls' Agricultural Clubs	110,000
386	Potato Culture on Irrigated Farms of the West	35,000
387	The Preservative Treatment of Farm Timbers	25,000
388	Experiment Station Work—LVI	25,000
389	Bread and Bread Making	130,000
390	Pheasant Raising in the United States	25,000
391	Economical Use of Meat in the Home	900,000
392	Irrigation of Sugar Beets	20,000
393	Habit-forming Agents	50,000
394	The Use of Windmills in Irrigation in the Semiarid West	15,000
395	Sixty-day and Kherson Oats	15,000
396	The Muskrat	15,000
397	Bees	20,000
398	Farm Practice in the Use of Commercial Fertilizers in the South Atlantic States	20,000
399	Irrigation of Grain	15,000
400	A More Profitable Corn-planting Method	20,000
401	The Protection of Orchards in the Pacific Northwest from Spring Frosts by Means of Fires and Smudges	20,000
402	Canada Bluegrass: Its Culture and Uses	15,000
403	The Construction of Concrete Fence Posts	30,000
404	Irrigation of Orchards	20,000
405	Experiment Station Work—LVII	15,000
406	Soil Conservation	30,000
	Total (45 bulletins)	2,915,000

POPULARITY OF FARMERS' BULLETINS.

As illustrating the popularity of the Farmers' Bulletins reference may be made to No. 391, Economical Use of Meat in the Home, issued March 23, 1910, and eight times reprinted, the aggregate number of copies printed and distributed during the year being 900,000. A reprint of 500,000 copies was authorized by Congress, making a total of 1,400,000 of this bulletin. Other Farmers' Bulletins on the subject of nutrition were also in great demand. The demand for Farmers' Bulletins was unprecedented and it was with some difficulty and not without some delay that the orders for printing them were executed. There is an increasing demand for these popular bulletins from schools of all grades and from higher educational institutions, where they are used in connection with the courses of instruction, which it is extremely desirable to supply, but which it is not possible to do with the present appropriation for printing these bulletins.

MISCELLANEOUS DISTRIBUTION OF FARMERS' BULLETINS.

Prior to 1908 the appropriation for Farmers' Bulletins appeared in the agricultural appropriation bill and contained a provision that congressional quotas not distributed prior to the end of the fiscal year should revert to the Secretary of Agriculture, and under this provision it was possible either to increase the new quotas for the succeeding year or to more fully comply with the miscellaneous requests received by the Department. The Secretary's quota of one-fifth is not sufficient to satisfy the demands made upon it. The provision has been omitted from the appropriation since it was transferred to the general printing bill and the result has been the congestion in the Department's limited storage space of a large num-

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ber of Farmers' Bulletins, due to and held upon demand by Senators, Representatives, and Delegates and being withheld from general distribution under the assumption that they might possibly need and call for these documents at some future time. The restoration to the appropriation bill of the above-mentioned provision would greatly relieve the present congestion, enable the Department to furnish the copies desired by deserving miscellaneous applicants and educational institutions, permit compliance with requests of Senators and Representatives who have need for more than their allotment, and cause no inconvenience to such as may not desire to distribute their supply.

As a further proof of the popularity of the Farmers' Bulletin series, attention is directed to the number sold by the Superintendent of Documents, namely, 47,148, at 5 cents per copy, although ordinarily the pamphlet can be secured free by application either to the Department or to a Senator or Representative in Congress.

THE YEARBOOK FOR 1909.

The Yearbook for 1909 deserves special mention. The volume was, by direction of the Secretary, reduced about one-third in size, and issued April 25, 1910—earlier than ever before. Its prompt delivery met with the commendation of Senators, Representatives, and Delegates in Congress and the public generally, and its reduced size not only resulted in a saving of about $6,000, but presented a volume more convenient for use and more permanent in character. For the first time the entire expense of the publication was paid from the fund for the fiscal year in which it was ordered, as the entire work was accomplished in that fiscal year.

EXPENDITURES FOR PRINTING.

The number of requisitions for printing drawn upon the Government Printing Office during the year was 5,853, of which 4,202 were on the main office and 1,651 on the branch office. The allotment for printing and binding for the Department for the year provided in the act making appropriations for the sundry civil expenses of the Government was $460,000, the same as for each of several preceding years. Of this amount $25,000 for the Weather Bureau printing was expended by that Bureau. Of the remaining $435,000 the expenditures for the various Bureaus, Divisions, and Offices aggregated $289,770.57, being $22,593.80 less than spent for similar purposes for the year 1909; and $126,579.37 was spent for Farmers' Bulletins, an increase of $4,103.89 over the amount expended for Farmers' Bulletins for the previous year.

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The amount expended from the printing fund for miscellaneous publications and for job printing for the various Bureaus, Divisions, and Offices is given in the following table:

Amount expended for the various Bureaus, Divisions, and Offices for printing and binding, 1910.

Bureau, Division, or Office.	Work done at—		Total.
	Main office.	Branch office.	
Division of Accounts	$5,874.55	$416.16	$6,290.71
Bureau of Animal Industry	19,187.95	2,649.98	21,837.93
Biological Survey	4,512.78	122.88	4,635.66
Bureau of Chemistry	9,637.21	569.19	10,206.40
Bureau of Entomology	10,256.17	772.16	11,028.33
Office of Experiment Stations	31,376.95	834.71	32,211.66
Forest Service	18,644.87	2,602.87	21,247.74
Library	10,157.61	112.56	10,270.17
Bureau of Plant Industry	25,940.66	2,591.45	28,532.11
Division of Publications	11,338.84	1,235.38	12,574.22
Office of Public Roads	1,566.02	188.17	1,754.19
Bureau of Soils	4,984.42	175.14	5,159.56
Bureau of Statistics	23,798.25	2,230.30	26,028.55
Office of the Secretary	17,486.70	1,780.03	19,266.73
Congressional	78,726.61	.....	78,726.61
Total	273,489.59	16,280.98	289,770.57
Expended for Farmers' Bulletins	.....	.....	126,579.37
Expenditure by Weather Bureau	.....	.....	25,000.00
Grand total	.....	.....	441,349.94

As the foregoing table does not show the character of the work for which expenditures were made, the following table has been compiled to show amounts expended for the various classes of publications and for job printing and binding:

Expenditures for different classes of publications, etc.

Farmers' Bulletins	$126,579.37
Congressional publications	78,726.61
Periodical publications	38,839.42
Bulletins, circulars, extracts, etc	83,116.70
Administrative and minor publications, job printing and binding	89,087.84
Total	416,349.94

Under job printing, mentioned in the foregoing statement, come stationery, circular letters, maps, blank forms, and a variety of miscellaneous supplies for which expenditures are necessarily large and have been growing rapidly owing to the increased fieldwork of the Bureaus. There has also been a large increase in the expenditures for the publishing of administrative publications issued for the guidance of officers and employees, such as Food Inspection Decisions, Notices of Judgment, Service Announcements, Field Programmes, etc., the cost of which has decreased the amount available for printing bulletins and circulars, the vehicles through which are given to the public the results of the original researches of the Department. This year but slightly over $82,000 was available for this purpose. Through rigid economy the expenses for printing have been kept at the lowest possible point, the only increases noted being for congres-

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sional publications, brought about because the entire cost of the Yearbook fell upon this year's appropriation, while previously it was divided between the two fiscal years in which the work was done by the Government Printing Office, and the slightly larger sum spent for Farmers' Bulletins. In addition to the publications issued during the fiscal year for which this report is made, requisitions involving the expenditure of about $19,000 were made upon the Government Printing Office, but the work was not undertaken because of the unusual demands upon that office for congressional and other printing. In some instances the work was undertaken but not completed. This fact accounts for the apparent balance of $19,000 in the printing fund; but this expense, though properly belonging to the year 1910, will fall upon the appropriation for the current year (1911).

The following tables give a comparison of publication work of the Department for the years 1907–1910, inclusive.

Output of publications from the Department for the fiscal years 1907, 1908, 1909, and 1910 compared.

	1907.	1908.	1909.	1910.
Number of editions issued	1,415	1,522	1,758	1,983
Number of copies printed	16,749,610	16,875,515	17,190,345	25,190,469

SALE OF PUBLICATIONS OF THE DEPARTMENT.

The sale of publications of this Department shows a steady growth; the number of documents sold during the past year was 147,327, an increase of 30,109 over the previous year, and the amount received was $18,398.18, an increase of $2,105.08. The average price per document was about 12½ cents, a decrease of 1½ cents, showing an increase in the proportion of the smaller publications sold. The work of the Department for forty-eight years from the passage of the organic act to the end of the fiscal year 1910 was represented in the publications sold; they ranged from the annual report for 1862 to the latest publication issued.

As in previous years, the publications ranged in size from one-page leaflets to bound volumes of 1,300 pages; in price they ranged from 5 cents for the smaller publications to $5.35 for the Field Operations of the Bureau of Soils for 1903 and $10 for Bulletin Q of the Weather Bureau.

The greatest number of any publication sold was 6,083 copies of Bulletin 121 of the Bureau of Animal Industry on the Need of Controlling and Standardizing the Manufacture of Veterinary Tetanus Antitoxin. The largest income from one publication was, as in the previous year, from the sale of 1,814 copies of the Special Report on Diseases of the Horse, at 65 cents, making a total of $1,179.10.

It is rather remarkable that 4.255 copies were sold of Farmers' Bulletin 391, Economical Use of Meat in the Home, notwithstanding the fact that this bulletin had the largest free distribution of any publication ever issued by the Government.

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The enormous increase in the sales of the Department's publications within recent years is shown in the following table:

Sales of agricultural publications by the Superintendent of Documents during the fiscal years 1906–1910.

Year.	Number of copies.	Amount received.
1906	47,745	$5,388.28
1907	71,764	10,885.20
1908	94,926	14,174.22
1909	117,218	16,293.10
1910	147,327	18,398.18

It will be observed that within five years the number of copies sold has increased over 205 per cent, while the amount received has increased more than 240 per cent.

No other Government publishes as many public documents as the United States, and no other executive department of the Government issues as many publications as the Department of Agriculture. It is the function of this Department to acquire and disseminate useful information in regard to agriculture. With the rapid increase in population of the country and the consequent increasing demand for publications it became apparent many years ago that the Department could probably never secure an appropriation sufficient for printing enough documents to supply the demand. Congress has, however, provided a solution of the problem by authorizing the sale of government publications at a nominal price. Under the operation of a provision of the law, the Superintendent of Documents can reprint and sell any publication, so long as there is a demand for it, without any expense to this Department. Consequently, by paying the price affixed by law, applicants are able to secure documents which can no longer be obtained from the Department, and which would not otherwise be available, owing to the insufficiency of the Department's fund for printing additional copies. It has become necessary, therefore, to continue the policy of referring miscellaneous applicants for scientific or technical publications to the Superintendent of Documents when the limited editions of the Department are exhausted and it is not possible to order additional copies.

In 1906 the Superintendent of Documents reprinted 43 publications of this Department, the total number of copies issued being a little more than 10,000. During the past year he reprinted 462 different publications, issuing a total of 112,092 copies, an increase in four years of more than 1,000 per cent.

The character of the publications of this Department reissued by the Superintendent of Documents is shown by the following table:

Classes of agricultural publications reissued by the Superintendent of Documents during the fiscal year 1910.

Class of publications.	Number.	Copies.
Bulletins	180	53,862
Circulars	22	4,250
Experiment Station Records	20	2,000
Farmers' Bulletins	240	51,980
Total	462	112,092

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The following table shows the agricultural publications reissued by the Superintendent of Documents, classified according to the main branch of the Department which originally contributed them:

Agricultural publications reissued by the Superintendent of Documents during the fiscal year 1910, classified according to the Bureau or Office originally contributing them.

Bureau or Office.	Number.	Copies.
Office of the Secretary	1	50
Bureau of Animal Industry	16	8,200
Biological Survey	3	500
Bureau of Chemistry	26	9,447
Bureau of Entomology	30	4,700
Office of Experiment Stations	49	10,505
Forest Service	27	7,050
Bureau of Plant Industry	55	15,600
Office of Public Roads	4	1,000
Bureau of Soils	10	2,000
Weather Bureau	1	1,000
Farmers' Bulletins	240	51,980
Total	462	112,092

Under the law of January 12, 1895, all remittances for publications should be forwarded to the Superintendent of Documents, Government Printing Office. By instructions conspicuously printed at the head of the Monthly List of Publications correspondents are advised to apply to that official when they desire to obtain any publication to which a price is affixed. Notwithstanding all effort to prevent it, however, money in payment for publications continues to come to this Division, the amount received during the fiscal year being $1,270.27, all of which had to be forwarded to the Superintendent of Documents by registered mail. A careful record of all amounts so received and forwarded is kept in the Division.

EDITORIAL WORK.

Through the editorial work, under the immediate supervision of the Assistant Chief, this Division labors not only for economy in the expenditure of printing funds, but for improvement in the character of the publications. This work has been carried along the same lines of previous years, no increase being made in the force and but little change in the personnel. As heretofore, every manuscript submitted for publication during the year has been subjected to the most painstaking editorial scrutiny. In all cases where the subject-matter treated embraces the work of Bureaus other than that submitting the manuscript, it has been referred to the offices interested in order to receive the benefit of their expert criticism and revision.

The number of new publications receiving attention was 1,074, containing 25,301 printed pages. Of these, the Reports of the Chiefs, the extracts and separates, and the Soil Survey Advance Sheets represent parts of larger publications issued separately. All these came to the Division of Publications in manuscript form and passed out of it in the final form in which they appeared in print.

The job work of the Department also involved a great amount of work in making up new forms, verifying copy, preparing for the printer, and reading proof, and as the Department extends its inves-

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tigations and experiments, the job work must necessarily increase, both in the amount and variety. It will be noted in the table on page 12 that the expenditure for administrative and minor publications, job printing, and binding was considerably less than for the preceding year. This saving was due not only to the constant effort to keep down the expense, but also to the transfer of the cost of certain minor publications to other items in that table.

AMOUNT OF WORK.

As may be readily understood, it is impossible to show in detail the work done by an editorial staff, as it is difficult to give statistically the amount of work expended on a manuscript submitted and for sufficient reasons withheld from publication, or on the reduction, rearrangement, and other improvements made in the manuscripts published; the output of books always being in inverse proportion to the amount of work expended upon the manuscript.

The accompanying table presents a complete statement of the publications issued by the Department. It shows separately the new publications of the year, the older publications reprinted, with the number of printed pages and the number of copies in each class, and the last three columns contain the totals for both classes. The table also shows separately the Farmers' Bulletins and other publications with the totals for the two classes combined for each Bureau, Division, and Office of the Department, and for the Department as a whole:

Publications issued by the Department during the fiscal year 1910, classified according to the Bureau, Division, or Office contributing them.

ALL PUBLICATIONS EXCEPT FARMERS' BULLETINS.

Bureau, Division, or Office contributing publications.	New.			Earlier issues reprinted.			Total.		
	Number.	Pages.	Copies.	Number.	Pages.	Copies.	Number.	Pages.	Copies.
Secretary's Office:									
Congressional	30	6,836	889,219	.....	.....	.....	30	6,836	889,219
Departmental	359	1,276	4,781,600	17	106	100,000	376	1,382	4,881,600
Division of Accounts	1	42	200	.....	.....	.....	1	42	200
Bureau of Animal Industry	85	1,536	348,725	24	699	84,500	109	2,235	433,225
Biological Survey	15	589	57,600	9	811	11,500	24	1,400	69,100
Bureau of Chemistry	27	876	61,220	13	1,902	13,250	40	2,778	74,470
Bureau of Entomology	67	2,042	170,000	27	341	89,500	94	2,383	259,500
Office of Experiment Stations	83	4,320	411,600	24	1,575	22,400	107	5,895	434,000
Forest Service	39	1,445	331,200	70	1,146	108,000	109	2,591	439,200
Library	10	499	9,350	.....	.....	.....	10	499	9,350
Bureau of Plant Industry	91	2,565	809,300	21	292	640,000	112	2,857	1,509,300
Division of Publications	163	673	4,318,155	.....	.....	.....	163	673	4,318,155
Office of Public Roads	4	92	31,200	6	125	11,000	10	217	42,200
Bureau of Soils	15	643	33,200	2	51	2,000	17	694	35,200
Bureau of Statistics	52	704	1,848,700	.....	.....	.....	52	704	1,848,700
Weather Bureau	434	2,002	609,550	.....	.....	.....	434	2,002	609,550
Total	1,475	26,140	14,770,819	213	7,048	1,082,150	1,688	33,188	15,852,969

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Publications issued by the Department during the fiscal year 1910, etc.—Cont'd.

FARMERS' BULLETINS.

Bureau, Division, or Office contributing publications.	New.			Earlier issues reprinted.			Total.		
	Number.	Pages.	Copies.	Number.	Pages.	Copies.	Number.	Pages.	Copies.
Bureau of Animal Industry	2	56	180,000	33	1,100	1,090,000	35	1,156	1,270,000
Biological Survey	5	224	205,000	5	153	60,000	10	377	265,000
Bureau of Chemistry	2	35	105,000	6	186	165,000	8	221	270,000
Bureau of Entomology	1	44	20,000	19	714	257,500	20	758	277,500
Office of Experiment Stations	17	649	1,705,000	82	2,691	1,895,000	99	3,340	3,600,000
Forest Service	1	19	35,000	6	205	200,000	7	224	235,000
Bureau of Plant Industry	15	336	605,000	82	2,318	2,310,000	97	2,654	2,915,000
Division of Publications				5	200	130,000	5	200	130,000
Office of Public Roads	1	31	30,000	5	138	165,000	6	169	195,000
Bureau of Soils				6	165	130,000	6	165	130,000
Weather Bureau	1	20	30,000	1	31	20,000	2	51	50,000
Total	45	1,414	2,915,000	250	7,901	6,422,500	*295	9,315	9,337,500

ALL PUBLICATIONS, INCLUDING FARMERS' BULLETINS.

Secretary's office:									
Congressional	30	6,836	889,219				30	6,836	889,219
Departmental	359	1,276	4,781,600	17	106	100,000	376	1,382	4,881,600
Division of Accounts	1	42	200				1	42	200
Bureau of Animal Industry	87	1,592	528,725	57	1,799	1,174,500	144	3,391	1,703,225
Biological Survey	20	813	262,600	14	964	71,500	34	1,777	334,100
Bureau of Chemistry	29	911	166,220	19	2,088	178,250	48	2,999	344,470
Bureau of Entomology	68	2,086	190,000	46	1,055	347,000	114	3,141	537,000
Office of Experiment Stations	100	4,969	2,116,600	106	4,266	1,917,400	206	9,235	4,034,000
Forest Service	40	1,464	366,200	76	1,351	308,000	116	2,815	674,200
Library	10	499	9,350				10	499	9,350
Bureau of Plant Industry	106	2,901	1,474,300	103	2,610	2,950,000	209	5,511	4,424,300
Division of Publications	163	673	4,318,155	5	200	130,000	168	873	4,448,155
Office of Public Roads	5	123	61,200	11	263	176,000	16	386	237,200
Bureau of Soils	15	643	33,200	8	216	132,000	23	859	165,200
Bureau of Statistics	52	704	1,848,700				52	704	1,848,700
Weather Bureau	435	2,022	639,550	1	31	20,000	436	2,053	659,550
Total	1,520	27,554	17,685,819	463	14,949	7,504,650	1,983	42,503	25,190,469

MISCELLANEOUS EDITORIAL WORK.

A large amount of miscellaneous editorial work was also performed, including compilation, abstracting, and original work. In many instances manuscripts have been submitted tentatively for expert editorial scrutiny, these having been returned to the authors with recommendations. Many press notices giving information to the public on agricultural subjects have also been prepared by the editors.

Much of the miscellaneous work of the editorial office is of so varied a character that it is impracticable to keep an exact record of it.

INDEXING.

Some progress was made during the year as compared with previous years, but the General Index of Department Publications still needs much work to make it properly effective, and this branch of the work would be more useful if its activities were better known to the investigators and writers of the Department who would most

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profit by them. The General Index, completed and made known to all, would afford everyone a means of ascertaining approximately all that has been published by the Department on any subject.

The Available Index has been improved and made more useful during the year. It gives very promptly the references on any subject to be found in the Department's available publications, and by reason of its simple dictionary form can be consulted readily by persons unfamiliar with either classification of subjects or methods of indexing. Proofs of this are constantly on hand in the daily work of this office. Many publications have been furnished to applicants by means of this index which would not have been reached by any other means.

Work on these indexes in order properly to represent the current publications in them has involved the copying of 97,782 index cards. Included in these, however, are a few thousand cards of entries from old Annual Reports made for the General Index. The books for the fiscal year 1908, during which work on the General Index was suspended for lack of help, have not as yet been indexed for that use; it is hoped this can be done in the current year. The addition of an indexer at the beginning of the year was a great help and has been justified by the additional work accomplished.

Letters prepared in this branch of the office during the year, most of them to supply special information about the Department publications and to give the titles of publications for sale by the Superintendent of Documents, numbered 6,925; the orders made numbered 7,899, there being frequently two orders for the same applicant. It is reasonable to suppose that these letters have been the cause in a large measure of the increase of sales of Department publications by that official.

The preparation of indexes for Department books during the year, besides those for the Secretary's Report, the Yearbook, and the Annual Reports, has included indexes for two volumes of Farmers' Bulletins, for several bulletins and reports of other Department offices, and an index of the minutes of the meetings of the Food and Drug Inspection Board, containing nearly 2,000 cards. In all, about 20,000 pages have been indexed.

The publication of the Monthly List of Publications, the revision of the lists of publications for sale and for free distribution, of the Farmers' Bulletin Subject Index, and of the Organization List has involved much time spent in compilation, editing, and proof reading, as in former years. An important feature in three of these circulars is the index, which it is believed will make them much more useful.

The custody and binding of the Department books for permanent preservation took some time, and the binding of such volumes as were complete was satisfactorily done.

ILLUSTRATIONS.

During the year 1,460 drawings were prepared by the draftsmen as compared with 1,061 in the preceding year, the bulk of the work being accomplished by three draftsmen, but the increase is not fully shown in the nearly 400 additional drawings. Many of these drawings were either large or intricate, requiring an exceptional amount of time and care.

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The growth of the photographic work shown in last year's report has continued and with no increase of force, the total amount of the output showing 99,122 pieces as against 44,989 in the preceding year. The accompanying tables give in detail the drafting and photographic work, but can not convey an adequate idea of the constantly increasing demand upon this office from the other Bureaus of the Department, nor do they show the amount of labor and skill necessarily required to produce such technically and artistically correct illustrations. Field work in the production of illustrations was done for the Bureaus of Animal Industry, Entomology, and Plant Industry.

The additional space secured during the last two years, now comprising the entire attic floor of the old main building, made it possible to increase the output of the force, but there is still need of additional apparatus and conveniences and quarters better adapted to the class of work performed. Proper ventilation and cooling of the dark rooms are imperative and would result in a still more satisfactory showing. The output of this office is primarily intended to illustrate reports of investigations conducted by the Department's scientific staff, and must be of the highest order, and as demands are constantly made upon the Department for photographic prints, lantern slides, etc., prepared from illustrations appearing in the Department's reports, negatives and original drawings of all such should be filed in this Division. While some progress has been made in this direction, a great majority of the Department's negatives are still scattered among the offices in the different Bureaus, and in the effort to comply with the increasing demands from miscellaneous applicants for photographic prints, lantern slides, etc., it frequently became necessary to devote much time to searching the files of the different Bureaus of the Department in order to locate and secure the negatives from which the prints or slides desired could be made. In many cases it was impossible to secure the original negative because of the unclassified condition of those in the possession of the Bureaus and of the authors of the documents.

These conditions emphasize the desirability of concentrating as far as possible all negatives and original drawings used in illustrating the Department's publications in this office. A conference in advance of the submission of illustrations with the expert in charge would result in securing the greatest possible volume of work for the least outlay of time and money.

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SUMMARY OF WORK DONE ON ILLUSTRATIONS.

The following is a detailed statement of the work done for each Bureau as well as the aggregate amount of work performed during the year ended June 30, 1910:

Photographic work done for the different Bureaus, Divisions, and Offices of the Department and for the public during the fiscal year ended June 30, 1910.

Bureau, Division, or Office.	Velox prints.	Lantern slides.	Negatives made.	Plates and films developed.	Lantern slides colored.	Bromide enlargements.	Blueprints.	Solar bromides.	Prints mounted.	Repro prints.	Negatives opaqued.	Moving picture films.	
												Negative.	Positive.
												Feet.	*Feet.*
Office of Secretary	26	44	.....	.....	8	.....	.....	.....	.....	.....	.....	.....	.....
Assistant Secretary	150	67	39	10	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chief Clerk	105	61	1	.....	2	4	.....	.....	.....	.....	.....	.....	.....
Chief Engineer	.....	.....	.....	.....	.....	.....	112	.....	.....	.....	.....	.....	.....
Bureau of Animal Industry	7,637	227	281	970	.....	77	4,731	51	26	.....	.....	.....	.....
Bureau of Chemistry	739	78	140	246	.....	4	403	159	.....	.....	.....	.....	.....
Bureau of Entomology	3,375	235	271	179	.....	25	24	.....	10	.....	.....	.....	.....
Office of Experiment Stations	1,067	953	377	91	3	60	1,481	353	30	.....	.....	.....	.....
Librarian	15	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bureau of Plant Industry	22,115	1,487	1,352	2,366	67	689	778	796	531	21	.....	.....	.....
Division of Publications	9,685	.....	61	.....	.....	.....	.....	17	.....	62	373	14,500	15,300
Office of Public Roads	591	37	25	78	.....	57	281	8	50	.....	.....	.....	.....
Bureau of Soils	317	.....	.....	78	.....	4	24	.....	.....	.....	.....	.....	.....
Bureau of Statistics	102	.....	8	.....	.....	.....	.....	83	.....	.....	.....	.....	.....
Biological Survey	30	.....	1	.....	.....	.....	.....	9	9	.....	.....	.....	.....
Paid orders	870	796	114	.....	.....	3	29	.....	.....	.....	.....	.....	.....

Summary of work on illustrations during the fiscal year ended June 30, 1910.

Photographic work:		
Velox prints		46,824
Blueprints		7,863
Solar bromides		1,476
Repro prints		83
Bromide enlargements		923
Prints mounted		656
Negatives made		2,675
Plates and films developed		4,018
Negatives opaqued		373
Lantern slides		3,985
Lantern slides colored		80
Moving-picture film	feet	29,800
Paid requisitions (amounting to $321.10)		171
Drawings, electrotypes, etc.:		
Drawings made		1,460
Requests received for duplicate electros		98
Duplicate electros furnished on request		734
Illustrations printed or published, not including reprints		2,475

HANDLING AND DISTRIBUTION OF PUBLICATIONS.

During the fiscal year there were distributed from the balance on hand July 1, 1909, and from the new supply issued during the year, 23,749,437 copies of publications and documents, leaving a balance on hand of 5,230,828. This is an increase over the total number distributed during the past fiscal year of over 6,000,000. Of the entire number of documents distributed, 13,656,967 were miscellaneous,

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leaving on hand July 1, 1910, 3,577,746 of this class of publications. Of Farmers' Bulletins 6,449,589 were mailed under orders from Members of Congress and 3,642,881 copies were distributed upon requests of miscellaneous applicants, being an increase in the congressional distribution over the previous year of 2,500,000 and an increased distribution upon miscellaneous requests of about 775,000, showing a net increase over the preceding year of slightly more than three and a quarter million Farmers' Bulletins, and leaving on hand 1,673,052 copies. A great increase in the number of miscellaneous publications is partially explained by the great number of copies of Notices of Judgment and the inclusion of Press Notices and Crop Reports under the head of "Publications."

To handle the publications issued by the Department involves an enormous amount of work, both clerical and manual. The work of storing and mailing the publications is divided principally between two mailing rooms; miscellaneous publications, some of which are heavy and bulky, are mailed under the direction of the foreman of the miscellaneous folding room and by the men under his charge. The Farmers' Bulletins are distributed by and the principal work incident to mailing them is under the direction and supervision of the forewoman in charge of a number of women employees, who by reason of long service in the Department are exceptionally skillful in arranging and mailing the orders. The amount of detail in connection with the mailing of Farmers' Bulletins, particularly those ordered out on the requests of Members of Congress, is increasing, as the practice adopted by many Members of Congress of distributing thousands of lists, showing the Farmers' Bulletins available to their constituents, with the request that the publications desired be checked and returned to this office in order that the publications may be mailed, necessitates a separate assembling of each particular request, as rarely will there be two persons who will select the same combination of numbers. This assembling of the bulletins in separate sets adds greatly to the work of this force, which for a number of years has been pressed to the limit of its capacity.

STENCIL MAILING LISTS.

There are now maintained 1,180,316 stencil addresses, 111,790 being added within the last fiscal year. This work has become a most important feature, as there are maintained at the present time the mailing lists of nearly every Bureau, Office, and Division in the Department. This work is done under a clerk in charge, and the employees, principally active young men, have addressed 5,289,252 franks and envelopes during the past year and cut 133,123 stencils, which were corrections of and additions to the various lists maintained on the stencil system. In addition, 5,499,574 publications were folded by this force on the machines provided for that work. Because of the removal of the branch printing office from the Department, it was found necessary to install a cutting machine in this room, and while it has been in use only a few months there have already been 655,990 sheets cut and trimmed, not including 563,964 franks furnished by Members of Congress. The work done by this force is commendable, the operators of the folding machines frequently having to work at night in order to have publications folded, ready for mailing next

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morning. The work at present is greatly handicapped, and becomes more so each day, by reason of the fact that there is not sufficient space to properly store the stencil cabinets and machinery, to say nothing of the number of envelopes that it is necessary to have within reach in order to expeditiously run off the various mailing lists. The question of storage space has become a serious problem, as in the case of some lists, among others the Crop Reporter list, it has been necessary to discontinue cutting stencils, as there is no room to store them.

The following are the lists maintained on the stencil system in this office, with number of names on each list:

Agrostology	2,559
Bureau of Animal Industry, Dairy Division	271
Biological Survey	878
Bureau of Chemistry	4,310
Bureau of Entomology	554
Forest Service	761,715
Library	542
Office of Experiment Stations	13,927
Bureau of Plant Industry	29,387
Division of Publications	254,118
Office of Public Roads	3,713
Bureau of Soils	271
Bureau of Statistics	107,830
Solicitor's Office	242

INTRODUCTION OF SIMPLIFIED METHODS.

The demand for the publications issued by the Department increased greatly during the past year; in fact, so much so that during the fall and winter of 1909–10 the force was taxed to its utmost to handle the applications with anything like promptness, and it was, owing to this continued and increased demand from all parts of the country, found necessary to make some change in the method of handling the applications from miscellaneous applicants. A new plan was put into effect April 6, 1910, and has given satisfactory results. There are received daily about 2,000 requests from Senators, Representatives, and Delegates in Congress, and from miscellaneous applicants, aggregating about 52,000 per month, or considerably over 624,000 in the course of a year. To handle the miscellaneous requests of applicants alone required the addressing of 619,694 envelopes or franks and 30,000 postal cards, and the using of 60,848 orders for miscellaneous publications and 198,400 orders for Farmers' Bulletins. Even with the simplified method the work of complying with the requests involves an enormous amount of clerical work, which requires extreme care, accuracy, and knowledge of the Department's publications and general work of the Department, which can be gained only by long experience.

The correspondence in connection with the distribution of publications furnished a good example of the amount of work of this character involved and the increase of the same. Despite the fact that thousands of blank forms and printed cards are used in reply to correspondents the number of letters that it was necessary to write was 56,901, showing an increase of 10,848 over the number written the year previous.

Another feature of the work which is exceedingly important is that of keeping account of the number of the various publications

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received in this Department, as, according to law, a detailed report must be submitted, showing the number of publications received and the number distributed during the fiscal year.

A division was made in the work of mailing the publications and storing them. A clerk was put in charge of the receiving and storing of all publications received, who furnishes the mailing rooms, upon application, with the publications needed for distribution. These requisitions are totaled at the end of the day and turned over to the bookkeeper. This is considered to be a more simple and expeditious method than the one formerly in vogue, which required considerable clerical work after the order had been filled to determine the number of any particular publication that was to be charged as distributed.

The change in the method of distributing the Department's publications having made possible the abolishment of a considerable amount of clerical work, and an immense amount of skilled labor being necessary to handle the mailing of the publications, it was possible to assign temporarily for that work some members of the clerical force; and it should be stated to their credit that they responded in a highly creditable manner, and considering the fact that they were unaccustomed to such duties, which are more or less arduous and laborious, they did an immense amount of work and were largely instrumental in bringing and keeping the work of mailing the Farmers' Bulletins up to date.

FOREIGN MAIL.

The demand for publications of the Department from foreign applicants continues to increase steadily, and during the year 1909–10 there were forwarded from this office, by authority furnished by the Library, 110,688 packages, containing publications weighing 38,802 pounds, involving an expenditure for postage of $2,572.52. This is an increase in packages of 20,719, in pounds of 9,042, and in postage of $519.97 over the previous year. A detailed report showing the number of packages and pounds, together with the amount expended by the various Bureaus, Divisions, and Offices for postage, is herewith submitted.

Summary for report of foreign mail for the year ending June 30, 1910.

Bureau, Division, or Office.	Number of packages.	Weight.	Postage.
Division of Publications	20,596	644.3	$221.18
Library	18,555	8,155.5	741.58
Office of Experiment Stations	13,269	9,184.9	734.79
Bureau of Chemistry	10,550	2,066.0	169.28
Bureau of Entomology	4,982	1,719.5	137.56
Bureau of Plant Industry	4,439	2,101.3	168.10
Bureau of Statistics	3,876	840.8	67.27
Bureau of Animal Industry	3,465	2,051.1	164.09
Forest Service	2,141	535.0	42.88
Biological Survey	1,219	933.5	74.68
Bureau of Soils	893	450.1	36.01
Office of the Secretary	66	172.1	13.77
Office of Public Roads	25	16.7	1.33
Total for fiscal year 1910	84,076	28,870.8	2,572.52
Total for fiscal year 1909	62,707	22,301.7	2,052.55
Excess over fiscal year 1909	21,369	6,569.1	519.97

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Packages sent abroad during fiscal year 1910.

Item.	Number.	Weight.	Postage.
Packages sent (Canada, Cuba, and Mexico not included)	84,076	28,870.8	$2,572.52
Packages sent to Canada, Cuba, and Mexico	26,027	7,979.7	None.
Packages sent through International Exchange	585	1,951.5	None.
Total	110,688	38,802.0	2,572.52

The distribution of the Department's publications to foreign countries under paid postage was 84,076 packages, as against 62,707 for the preceding year, weighing 28,870.8 pounds, as compared with 22,301.7 pounds for 1909, requiring $2,572.52 for postage, as against $2,052.55 for the previous year; and 26,027 packages weighing 7,979.7 pounds were sent to Canada, Cuba, and Mexico under frank, making a total of 110,688 packages, weighing 38,802 pounds, or nearly 19½ tons of the Department's publications, forwarded to residents of foreign countries. This increase and great aggregate suggest the advisability and necessity of a general revision of foreign mailing lists of the various Bureaus, Divisions, and Offices with the view to ascertaining whether the restrictions of General Order No. 96, of April 14, 1906, have been effective, and, if not, what modifications should be made.

MISCELLANEOUS WORK.

The Division is called upon to do an enormous amount of miscellaneous work for other Bureaus, Divisions, and Offices in the way of addressing envelopes and franks and furnishing mimeograph copies of press notices. During the year miscellaneous lists have been written for other Bureaus, Divisions, and Offices, comprising 91,433 addresses, this being in excess of the work done in 1909 by over 8,000 addresses, as shown below:

Franks addressed for other Bureaus, Divisions, and Offices, Miscellaneous Lists, etc.

Addressed franks written during the fiscal year ending July 1—	
1910	91,433
1909	83,429
Excess of work done in 1910 over 1909	8,004

WORK OF THE DIVISION FOR 1911.

The work during 1911 will be continued along the same lines as heretofore, and with the same constant effort to increase the Division's usefulness, and to secure the largest and most satisfactory output of work with the available funds.

RECOMMENDATIONS FOR 1912.

The demand for Farmers' Bulletins is greater than ever before—far in excess of the ability of the Department to supply. An increase in the appropriation for printing them seems to offer the only solution of the problem. With an increase in the present appropriation the

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quotas of Senators, Representatives, and Delegates in Congress could probably be increased and the Department's allotment correspondingly enlarged.

CONCENTRATION OF WORK.

The committee on photographic work appointed in 1905 reported, under date of October 8, 1905, in part as follows:

> That all photographic work involving expensive equipment and expensive apparatus should be performed as far as possible in a central studio under the Division of Publications, with the exception, however, of work involving microphotography; that the equipment of this central studio should be made as complete as possible so as to be fitted for the performance in the best manner of all kinds of photographic work * * *.

At that time there were no less than 19 dark rooms for photographic work in the Department, and the various Bureaus reported negatives and films on hand aggregating for the entire Department over 111,000. It was manifest from the letters accompanying replies to the interrogatories which the committee submitted to the chief of each Bureau for response that the opinion among the several chiefs was practically unanimous that a considerable amount of the photographic work is indispensable, and that a certain part of that work must be done by their own people under their own control. Many, however, conceded that all the work involving development and printing could be better done in the central office, their employees confining their work to the use of the camera; while others thought that a large part of the development and printing should be done in their own Bureaus, but admitted that the work involving the use of expensive apparatus and expensive equipment ought to be done in a central office.

Since the date of the above-mentioned report additional photographic laboratories and equipment have been secured by the different Bureaus, and much photographic and drafting work is still conducted in those offices. As in the editorial work, so in illustration of publications, this Division is prepared to offer expert advice and assistance, and if the authors of prospective publications would confer with it in the preparation of their illustrations the results would be more satisfactory in many respects; and only in this way can the illustrations of this Department reach the standard of excellence commensurate with the importance and dignity of its publications.

The Division is well equipped for the editing of manuscripts, the preparation of all copy for publication, and the proof reading and revising while passing through the press. It has the expert knowledge of such matters which is requisite to effect the economies absolutely necessary to secure the great volume of printing and binding required from the limited funds available for such purpose, and it would be along the line of retrenchment and economy if all editorial work were left entirely to this Division or placed under its supervision. Much duplicate work would be eliminated, greater uniformity in style would result, a considerable expenditure would be avoided, and an appreciable amount of time would be saved.

INCREASE IN COMPENSATION.

There are numerous employees in the Division of Publications who are rendering most satisfactory service whose salaries should be in-

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creased as soon as practicable to an amount commensurate with the character of the service and the efficiency with which it is performed.

A general increase in the salaries of the editorial assistants is earnestly recommended. They have been rendering conspicuously efficient service for years without promotion. There is not one of them who does not save the amount of his salary by economies effected in the publication work during the year.

PUBLICATIONS ISSUED DURING THE YEAR.

The list of publications issued during the year has been prepared with unusual care. It contains a considerable number of administrative and minor publications not listed in earlier reports of this Division. The list is, therefore, more complete than heretofore.

Publications [a] issued during the year ended June 30, 1910, by the U. S. Department of Agriculture: Class, title, author, size, price (if any), date of issue, editions, and total number of copies.

OFFICE OF THE SECRETARY.

CONGRESSIONAL.

NEW PUBLICATIONS.

	Copies for Department.	Copies for Congress.
Annual Reports:		
Annual Reports of the Department of Agriculture for the Year ended June 30, 1909. (Report of the Secretary of Agriculture and Reports of Chiefs.) 859 pp. May 24	50	3,237
Yearbook of the United States Department of Agriculture for 1908. 822 pp. $1.25. Aug. 12	30,000	332,024
Yearbook of the United States Department of Agriculture for 1909. 652 pp. $1. Apr. 25	30,000	382,000
Annual Report of the Office of Experiment Stations for year ended June 30, 1908. 417 pp. Cloth, 60 cents. Sept. 23	3,000	3,545
Twenty-Fourth Annual Report of the Bureau of Animal Industry, 1907. 486 pp. Cloth, 85 cents. Oct. 5	1,503	
Twenty-Fifth Annual Report of the Bureau of Animal Industry, 1908. 502 pp. Cloth, 70 cents. Mar. 15	6,500	25,671
Report of the Secretary of Agriculture, 1909. James Wilson. 169 pp. Dec. 6	5,000	
Field Operations of the Bureau of Soils, 1907. (Ninth Report.) By Milton Whitney, Chief, with accompanying papers by assistants in charge of field parties. 1,062 pp., pls. 54, figs. 35, maps 35 (in pocket). Cloth, $4.50; without maps, $1. Sept. 2	1,500	3,604
Report of the Weather Bureau for year ended June 30, 1908. 397 pp. 80 cents. Dec. 26	1,000	2,999

[a] Persons ordering publications from this list should note carefully the following: Farmers' Bulletins are for free distribution by the Members of both branches of Congress and by the Secretary of Agriculture. The same may be said of Soil Survey Advance Sheets. Circulars, Yearbook Extracts, Reports of Chiefs, and other Department publications for which no price is named are for free distribution by this Department so long as the editions last. Orders for Congressional publications for which no price is given should be addressed to Members of Congress. All orders for Bulletins and other priced publications should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C., and the amount of the price should be inclosed in the form of a postal money order. Stamps will not be accepted. Cash will be accepted, but the sender must stand the risk of loss.

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Publications issued during the year ended June 30, 1910, etc.—Continued.

OFFICE OF THE SECRETARY—Continued.

CONGRESSIONAL—Continued.

NEW PUBLICATIONS—Continued.

	Copies for Department.	Copies for Congress.
Soil Surveys (Advance Sheets, Field Operations of the Bureau of Soils, 1908):		
Grady County, Georgia. 67 pp. Sept. 10	1,000	1,000
Thomas County, Georgia. 64 pp. Sept. 9	1,000	3,000
Parkersburg Area, West Virginia. 36 pp. Sept. 20	1,000	3,000
East Carroll and West Carroll Parishes, Louisiana. 28 pp. Sept. 22	1,000	3,000
Franklin County, Texas. 32 pp. Sept. 30	1,000	3,000
Corpus Christi Area, Texas. 29 pp. Sept. 30	1,000	3,000
Henry County, Alabama. 35 pp. Oct. 12	1,000	3,000
Robeson County, North Carolina. 28 pp. Oct. 5	1,000	3,000
Wexford County, Michigan. 20 pp. Oct. 20	1,000	3,000
Colbert County, Alabama. 34 pp. Oct. 21	1,000	3,000
Holmes County, Mississippi. 32 pp. Oct. 27	1,000	3,000
Portersville Area, California. 40 pp. Nov. 20	1,000	3,000
Bienville Parish, Louisiana. 36 pp. Dec. 11	1,000	3,000
Richland County, North Dakota. 38 pp. Dec. 28	1,000	5,000
Montgomery County, New York. 42 pp. Dec. 27	1,000	3,000
Modesto-Turlock Area, California, with a brief report on a Reconnaissance Soil Survey of the Region East of the Area. 70 pp. Jan. 3	1,000	3,000
Livingston County, New York, with a chapter on orchard soils, and one on drainage. 91 pp. Feb. 5	1,000	3,000
Allen County, Indiana. 30 pp. Feb. 7	1,000	3,000
Bibb County, Alabama. 51 pp. Feb. 10	1,000	3,000
Klamath Reclamation Project, Oregon. 45 pp. Feb. 12	1,000	3,000
Pajaro Valley, California. 46 pp. Feb. 19	1,000	3,000
Calhoun County, Alabama. 49 pp. Feb. 26	1,000	3,000
Autauga County, Alabama. 43 pp. Mar. 7	1,000	3,000
Monroe County, Mississippi. 48 pp. Mar. 10	1,000	3,000
Western North Dakota. 80 pp. Apr. 1	1,000	3,000
Jefferson County, Alabama. 37 pp. Apr. 7	1,000	3,000
A Reconnoissance of Northwestern Pennsylvania. 51 pp. Apr. 9	1,000	11,000
Caswell County, North Carolina. 28 pp. May 26	1,000	3,000
Etowah County, Alabama. 31 pp. May 27	1,000	3,000
Center County, Pennsylvania. 52 pp. June 4	1,000	3,000
Camp County, Texas. 20 pp. June 20	1,000	3,000
Coffee County, Tennessee. 33 pp. May 28	1,000	3,000
Soil Surveys (Advance Sheets, Field Operations of the Bureau of Soils, 1909):		
Lake Mattamuskeet Area, North Carolina. 17 pp. May 16	1,000	3,000
Hancock County, Georgia. 27 pp. May 26	1,000	3,000
Pitt County, North Carolina. 35 pp. May 28	1,000	3,000
Reconnoissance of South Texas. 105 pp. June 17	1,000	3,000
House Documents (61st Cong., 2d sess.):		
No. 193. Expenditures Bureau of Chemistry to compensate persons employed by State or local Governments during the year ended Nov. 30, 1909. 2 pp. Dec. 13		1,206
No. 202. Statement of Expenditures of the Department of Agriculture for the Fiscal Year ended June 30, 1909. 555 pp. Dec. 13		1,101
No. 203. Expenditures for Travel from Washington to Points Outside of the District of Columbia Performed by Certain Officers and Employees of the Department of Agriculture During the Fiscal Year ended June 30, 1909. 147 pp. Dec. 18		1,625

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Publications issued during the year ended June 30, 1910, etc.—Continued.

OFFICE OF THE SECRETARY—Continued.

CONGRESSIONAL—Continued.

NEW PUBLICATIONS—Continued.

	Copies for Department.	Copies for Congress.
House Documents (61st Cong., 2d sess.)—Continued.		
No. 421. Combined Report of Expenditures during Fiscal Year ended June 30, 1909, Appropriations for 1910, and Proposed Expenditures for 1911. (Quarto.) 210 pp. Dec. 18		1,625
No. 425. Restoration of Weather Bureau Station at Sand Key, Florida, and Estimates of Appropriation for same. 2 pp. Dec. 18		1,206
No. 440. Fence on National Bison Range, Montana, Estimate of Appropriation to complete same. 2 pp. Dec. 27		1,206
No. 449. A Letter from the Secretary of Agriculture submitting Estimates for Appropriation for Inclusion in the Deficiency Bill, to reimburse Fenton T. Ross and Others. 22 pp. Dec. 27		1,206
No. 451. Deficiency Appropriation, Bureau of Chemistry, Letter from the Secretary of Agriculture submitting an Estimate for same. 2 pp. Jan. 15		1,206
No. 838. Documents Received and Distributed by Department of Agriculture During 1909. Letter of the Secretary of Agriculture, transmitting a Report of the Chief of the Division of Publications showing the documents received and distributed during the Fiscal Year ended June 30, 1909. 22 pp. Apr. 15		1,206

DEPARTMENTAL.

NEW PUBLICATIONS.

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Publications issued during the year ended June 30, 1910, etc.—Continued.

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Publications issued during the year ended June 30, 1910, etc.—Continued.

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DEPARTMENTAL—Continued.

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No. 309. Misbranding of "Coke Extract." 1 p. May 26	10,000
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No. 390. Adulteration and Misbranding of Powdered Colocynth. 2 pp. June 27	10,000
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No. 397. Misbranding of Olive Oil. 2 pp. June 27	10,000
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No. 399. Adulteration and Misbranding of Vinegar. 1 p. June 27	10,000
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No. 420. Adulteration of Milk. 1 p. June 28	10,000
No. 421. Adulteration of Milk. 1 p. June 28	10,000
No. 422. Misbranding of Canned Corn. 1 p. June 28	10,000
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No. 440. Misbranding of Canned Corn. 1 p. June 28	10,000
No. 441. Misbranding of Olive Oil. 1 p. June 28	10,000
No. 442. Misbranding of Canned Blueberries. 2 pp. June 28	10,000
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DEPARTMENTAL—Continued.

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No. 452. Adulteration and Misbranding of Oats. 1 p. June 28	10,000
Miscellaneous circulars:	
Regulations and Decisions Concerning Quarantines and Serial Numbers and their Uses. Food and Drug Act, Sec. 9. 13 pp. Dec. 11	10,000
Address delivered by W. M. Hays, Assistant Secretary of Agriculture, before the National Farm Land Congress, Chicago, Ill., Nov. 17, 1909. 3 pp. Nov. 17	1,400
The Twenty-eight-Hour Law, annotated. 28 pp. Oct. 12	500

EARLIER PUBLICATIONS REPRINTED.

Circulars:	
No. 21. Rules and Regulations for the Enforcement of the Food and Drugs Act of June 30, 1906. 20 pp. Nov. 19	15,000
No. 29. Test of Robert's So-Called Anti-Abortion Serum. 1 p. Aug. 27	1,000
Food-Inspection Decisions:	
Nos. 40–43. 40, Filing Guaranty. 41, Approval of Labels. 42, Mixing Flours. 43, Relabeling of Goods on Hand. 4 pp. Feb. 16	2,500
Nos. 49–53. 49, Time Required to Reach Decisions on Different Problems Connected with the Food and Drugs Act, June 30, 1906. 50, Imitation Coffee. 51, Coloring of Butter and Cheese. 52, Form of Label. 53, Formula on the Label of Drugs. 6 pp. Feb. 23	5,000
Nos. 54–59. 54, Declaration of the Quantity or Proportion of Alcohol Present in Drug Products. 55, Method of Stating Quantity or Proportion of Preparations (containing Opium, Morphine, etc.) Used in Manufacturing Other Preparations. 56, Names to be Employed in Declaring the Amount of the Ingredients as Required by Law. 57, Physicians' Prescriptions. 58, The Labeling of Products Used as Foods and Drugs, as well as for Technical and Other Purposes. 59, National Formulary Appendix. 7 pp. Feb. 26	5,000
Nos. 60–64. 60, Minor Border Importations. 61, Cocoa Butter Substitutes. 62, Guaranty on Imported Products. 63, Use of the Word "Compound" in Names of Drug Products. 64, Labeling of Sardines. 6 pp. Feb. 23	5,000
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Nos. 66–68. 66, The Use of Sugar in Canned Goods. 67, Polishing and Coating Rice. 68, Labeling of Food and Drug Products, "Manufactured for," "Prepared for," "Distributed by," etc. 5 pp. Feb. 25	5,000
No. 73. Interstate Transportation of Imported Meats and Meat-Food Products. 2 pp. Feb. 16	3,000
No. 74. Certificates of Imported Meats and Meat-Food Products of Cattle, Sheep, Swine, and Goats. 3 pp. Feb. 16	3,000
No. 76. Dyes, Chemicals, and Preservatives in Foods. 13 pp. Feb. 15	5,000
No. 84 and 85. 84, Amendments to Regulations 17 and 19. 85, Labeling of Bitters. 4 pp. Feb. 11	5,000
No. 90. The Labeling of Foods and Medicinal Mixtures for Stock and Poultry. 3 pp. Nov. 24	5,000
No. 91. The Labeling of Mocha Coffee. 2 pp. Feb. 16	2,500
No. 98. The Labeling of Whisky Compounds. 2 pp. Feb. 9	2,500
No. 99. Change in Form of Guarantee Legend. 2 pp. Nov. 6, 10,000; Feb. 16, 20,000	30,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

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DEPARTMENTAL—Continued.

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Nos. 5–11. 5, Misbranding of Vanilla Extract. 6, Misbranding of Cider. 7, Misbranding of Eggs. 8, Adulteration of Milk (Formaldehyde). 9, Adulteration of Milk (Water and Formaldehyde). 10, Misbranding of Cocaine Hydrochlorid. 11, Adulteration of Milk (Water). 10 pp. Jan. 27	3,000

DIVISION OF ACCOUNTS AND DISBURSEMENTS.

NEW PUBLICATION.

Annual Report:	
Report of the Chief of the Division for 1909. A. Zappone. (From An. Rpts. of Dept., 1909.) 42 pp. Dec. 18	200

BUREAU OF ANIMAL INDUSTRY.

NEW PUBLICATIONS.

Bulletins:	
No. 39. Index-Catalogue of Medical and Veterinary Zoology. Ch. Wardell Stiles and Albert Hassall. Part 24 (Authors: R to Rizzo). 21 pp. 10 cts. Oct. 9	2,000
No. 39. *Same.* Part 25 (Authors: Roack to Van Rzewuski). 85 pp. 10 cts. Nov. 30	2,000
No. 39. *Same.* Part 26 (Authors: S. to Schnyder). 99 pp. 10 cts. June 3	2,000
No. 115. Camembert Cheese Problems in the United States. Charles Thom. 54 pp. 15 cts. Oct. 6	3,000
No. 116. Tests Concerning Tubercle Bacilli in the Circulating Blood. E. G. Schroeder and W. E. Cotton. 23 pp. 5 cts. Aug. 18	3,000
No. 117. Leucocytes in Milk: Methods of Determination and the Effect of Heat Upon Their Number. H. C. Campbell. 19 pp. 5 cts. Oct. 18	3,500
No. 118. Cultural Studies of Species of Penicillium. Charles Thom. 109 pp. 10 cts. Feb. 8	1,000
No. 119. Studies on Blood and Blood Parasites. (1) Observations on Mammalian Blood with Dark Field Illumination. (2) The Priority of Cryptobia Leidy, 1846, Over Trypanoplasma Laveran and Mesnil, 1901. (3) Trypanosma Americanum n. sp.; A Trypanosome Which Appears in Cultures made from the Blood of American Cattle (Preliminary Notice). 31 pp. 5 cts. Oct. 22	3,200
No. 120. The Intracellular Enzym Penicillium and Aspergillus, with Special Reference to those of Penicillium Camemberti. Arthur Wayland Dox. 70 pp. 10 cts. Apr. 4	2,200
No 121. The Need of Controlling and Standardizing the Manufacture of Veterinary Tetanus Antitoxin. John R. Mohler and Adolph Eichhorn. 22 pp. 5 cts. Nov. 27	4,500
No. 122. Factors Controlling the Moisture Content of Cheese Curds. J. L. Sammis, S. K. Suzuki, and F. W. Laabs. 61 pp. 10 cts. May 31	3,500
No. 123. The Influence of Lactic Acid on the Quality of Cheese of the Cheddar Type. C. F. Doane. 20 pp. 5 cts. May 31	3,500
Circulars:	
No. 149. A Cold-Storage Evaporimeter. Milo M. Hastings. 8 pp. Sept. 14	3,000
No. 150. Regulations governing Entrance to the Veterinary Inspector Examination. 11 pp. Aug. 9	3,500
No. 151. Competitive Exhibitions of Milk and Cream, with Report of an Exhibition held at Pittsburg, Pa., in Cooperation with the Pittsburg Chamber of Commerce. C. B. Lane and Ivan C. Weld. 36 pp. Oct. 12	4,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

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No. 154. The Need of State and Municipal Meat Inspection to Supplement Federal Inspection. A. M. Farrington. 14 pp. Mar. 14	4,000
No. 155. Mycotic Lymphangitis of Horses. John R. Mohler.. 5 pp. Mar. 10	3,000
No. 156. Chronic Bacterial Dysentery of Cattle. John R. Mohler. 8 pp. Mar. 9	3,000
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No. 160. Lip-and-Leg Ulceration of Sheep. (1) The Work of the Bureau of Animal Industry for the Suppression of Lip-and-Leg Ulceration of Sheep, A. D. Melvin. (2) Lip-and-Leg Ulceration (Necrobacillosis) of Sheep: Its Cause and Treatment, John R. Mohler. 35 pp. Mar. 24	8,000
No. 161. Whey Butter, C. F. Doane. 7 pp. June 23	7,500
Annual Report:	
Report of the Chief of the Bureau for 1909, A. D. Melvin. (From An. Repts. of Dept., 1909.) 69 pp. Dec. 30	2,500
Yearbook Extracts:	
No. 476. Some Facts About Tuberculous Cattle, E. C. Schroeder. (From Ybk. 1908.) 13 pp. Aug. 31	2,500
No. 484. Recent Work of the Bureau of Animal Industry Concerning the Cause and Prevention of Hog Cholera, M. Dorset. (From Ybk. 1908.) 16 pp. July 26	2,500
No. 508. Tuberculosis of Hogs and How to Control It, John R. Mohler and Henry J. Washburn. (From Ybk. 1909.) 12 pp. June 30	1,000
Separates from Twenty-fifth Annual Report of Bureau (1908):	
The Economic Importance of Tuberculosis of Food-Producing Animals, A. D. Melvin. 15 pp. Mar. 2	1,000
The Relation of the Tuberculous Cow to the Public Health. E. C. Schroeder. 45 pp. Mar. 9	3,000
The Causation and Character of Animal Tuberculosis, and Federal Measures for its Repression, John R. Mohler. 12 pp. Mar. 4	1,000
The Control of Hog Cholera by Serum Immunization. A. D. Melvin. 8 pp. Mar. 1	1,000
The Effect of Smelter Fumes upon the Live-stock Industry in the Northwest. Robert J. Formad. 36 pp. Mar. 12	1,000
Malta Fever and the Maltese Goat Inspection. John R. Mohler and George H. Hart. 20 pp. Mar. 10	5,000
The Action of Saltpeter upon the Color of Meat. Ralph Hoagland. 16 pp. May 26	500
Notes on the Animal Industry of Argentina. George M. Rommel. 23 pp. Mar. 19	1,000

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State Legislation Regulating the Standing of Stallions and Jacks for Public Service. Roy A. Cave. 12 pp. Mar. 2	500
The 1908 Outbreak of Foot-and-Mouth Disease in the United States. A. D. Melvin. 16 pp. Mar. 12	1,000
Service Announcements:[a]	
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No. 30. For October, 1909. 7 pp. Oct. 18	5,000
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No. 35. For March, 1910. 6 pp. Mar. 18	5,000
No. 36. For April, 1910. 5 pp. Apr. 19	5,000
No. 37. For May, 1910. 8 pp. May 21	5,000
No. 38. For June, 1910. 8 pp. June 21	4,700
Index to Service Announcements for 1909. 6 pp. Mar. 12	2,500
Meat Inspection Directories:[b]	
Directory, revised to July 1, 1909. 41 pp. July 2	4,000
Same, revised to October 1, 1909. 39 pp. Oct. 14	4,075
Directories of The Bureau:	
Directory, revised to Jan. 20, 1910. 62 pp. Feb. 5	4,550
Same, revised to April 12, 1910. 61 pp. Apr. 22	4,000
Miscellaneous Circulars:	
Order of the Commissioners of the District of Columbia for the Suppression and Prevention of Tuberculosis in Cattle. 4 pp. Dec. 9	5,000
To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding Cattle for the Oklahoma State Fair (Amend. 2 to B. A. I. Order 158). 1 p. July 3	7,500
Designating Campo, Cal. (port of San Diego), as a Quarantine Station (Amend. 5 to B. A. I. Order 142). 1 p. July 22	2,500
To Prevent the Spread of Scabies in Sheep (Amend. 4 to B. A. I. Order 146). 1 p. Aug. 5	7,500
To Prevent the Spread of Lip-and-Leg Disease (Necrobacillosis) in Sheep (Rule 8 B. A. I. Order 163). 3 pp. Aug. 6	7,500
To Prevent the Spread of Scabies in Sheep (Amend. 5 to B. A. I. Order 146). 1 p. Aug. 7	7,500
To Prevent the Spread of Scabies in Cattle (Amend. 3 to B. A. I. Order 152). 1 p. Aug. 19	7,500
To Prevent the Spread of Scabies in Sheep (Amend. to B. A. I. Order 146). 2 pp. Aug. 20	7,300
Special Order Providing for the Importation of Canadian Sheep for Exhibition Purposes at the International Live Stock Exposition, Chicago, Ill. (B. A. I. Order 146). 1 p. Sept. 2	7,500
To Prevent the Spread of Lip-and-Leg Disease (Necrobacillosis) in Sheep (Amend. 1 to B. A. I. Order 163). 1 p. Sept. 10	7,500
To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding the Return of Cattle of the Nonquarantined Area that are exhibited at the North Carolina State Fair at Raleigh, N. C., Oct. 18–23, 1909 (Amend. 3 to B. A. I. Order 158). 2 pp. Sept. 23	7,500
To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding Cattle for the Tri-State Fair in Memphis, Tenn. (Amend. 4 to B. A. I. Order 158.) 1 p. Sept. 25	7,500

[a] Not for general circulation, but for distribution to persons in the service of the Bureau and to proprietors of establishments covered by the meat inspection.

[b] Additional data included and title changed to Directory of the Bureau of Animal Industry, beginning with January number, 1910.

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF ANIMAL INDUSTRY—Continued.

NEW PUBLICATIONS—Continued.

	Copies.
Miscellaneous Circulars—Continued.	
Amendment to Regulation 9 of the Regulations for the Inspection and Quarantine of Horses, Cattle, Sheep, and Other Ruminants, and Swine Imported into the United States. (Amend. 6 to B. A. I. Order 142.) 1 p. Sept. 28	5,000
Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees. Certification of Foreign Affiliated Associations. (Amend. 8 to B. A. I. Order 136.) 1 p. Sept. 28	2,000
Same. Withdrawal of Certification. (Amend. 9 to B. A. I. Order 136.) 1 p. Oct. 1	2,000
Same. Certification of Association. (Amend. 10 to B. A. I. Order 136.) 1 p. Oct. 2	2,000
Same. Certification of Various Associations. (Amend. 11 to B. A. I. Order 136.) 1 p. Oct. 21	2,000
Same. Withdrawal of Certification. (Amend. 12 to B. A. I. Order 136.) 1 p. Apr. 1	2,000
To Prevent the Spread of Splenetic Fever in Cattle. (Amendment 5 to B. A. I. Order 158.) 3 pp. Oct. 5	7,500
Regulations of the Secretary of Agriculture Governing the Inspection, Disinfection, Certification, Treatment, Handling, and Method and Manner of Delivery and Shipment of Live Stock which is the Subject of Interstate Commerce—Revised. B. A. I. Order 143.) 31 pp. Oct. 12	2,500
Amendment to Regulation 41, Providing for the Dipping or the Quarantine of Sheep Imported from Canada for Breeding, Grazing, or Feeding. (Amend. 7 to B. A. I. Order 142.) 2 pp. Oct. 18	5,000
Amendment to Regulation 49, Providing for the Dipping Twice of Sheep Imported from Mexico for Breeding, Grazing, or Feeding. (Amend. 8 to B. A. I. Order 142.) 1 p. Oct. 23	3,000
Regulations Concerning the Importation of Hay and Straw from Continental Europe, Importation of Hay and Straw from Belgium and Denmark. (Amend. 3 to B. A. I. Order 129.) 1 p. Nov. 15	3,000
To Prevent the Spread of Lip-and-Leg Ulceration (Necrobacillosis) in Sheep. (Rule 8, Revision 1, B. A. I. Order 165.) 4 pp. Nov. 22	7,500
Amendment to Regulation 1, Designating Rio Grande City and Edinburgh, Texas, as Ports for the Entry of Animals which are Subject to both Inspection and Quarantine. (Amend. 9 to B. A. I. Order 142.) 1 p. Nov. 27	5,000
To prevent the Spread of Splenetic Fever in Cattle. (Rule 1, Revision 5, B. A. I. Order 166.) 10 pp. Dec. 2	8,000
To Prevent the Spread of Scabies in Cattle. (Rule 2, Revision 3, B. A. I. Order 167.) 3 pp. Dec. 22	7,500
To Prevent the Spread of Splenetic Fever in Cattle. (Rule 1, Revision 6, B. A. I. Order 168.) 11 pp. Mar. 12	7,500
Amendment to Regulation 45, B. A. I. Order 142, for the Purpose of Preventing the Importation from Mexico of Horses Infested with Ticks (*Margaropus annulatus*) into Any Area of the United States from which Cattle are Excluded on Account of Ticks. (Amend. 10 to B. A. I. Order 142.) 2 pp. June 1	5,000
Farmers' Bulletins:	
No. 378. Methods of Exterminating the Texas-Fever Tick. H. W. Graybill. 32 pp. Oct. 26, 30,000; Dec. 17, 15,000; Mar. 10, 20,000; Apr. 19, 20,000	85,000
No. 379. Hog Cholera. M. Dorset. 24 pp. Nov. 29, 30,000; Jan. 14, 15,000; Jan. 18, 10,000; Mar. 2, 20,000; May 13, 20,000	95,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF ANIMAL INDUSTRY—Continued.

EARLIER PUBLICATIONS REPRINTED.

	Copies.
Circulars:	
No. 23. 3d revision, Directions for the Use of Blackleg Vaccine. Victor A. Norgaard. 8 pp. Oct. 9	10,000
No. 31. 2d revision, Blackleg: Its Nature, Cause, and Prevention. Victor A. Norgaard. 24 pp. Dec. 7	5,000
No. 68. Diseases of the Stomach and Bowels of Cattle. A. J. Murray. (Revised by L. Pearson in 1900 and R. W. Hickman in 1908.) 14 pp. Nov. 24, 3,000; Jan. 27, 3,000	6,000
No. 70. Tuberculosis of Cattle. D. E. Salmon and Theobald Smith. 28 pp. Mar. 9	2,000
No. 71. Anthrax in Cattle, Horses, and Men. D. E. Salmon and Theobald Smith. 10 pp. Oct. 6	2,000
No. 89. The Preparation of Emulsions of Crude Petroleum. T. M. Price. 4 pp. Aug. 28, 2,000; Dec. 8, 5,000	7,000
No. 91. Bacillus Necrophorus. John R. Mohler and George Byron. 42 pp. Mar. 25	1,000
No. 103. Records of Dairy Cows: Their Value and Importance in Economic Milk Production. C. B. Lane. 38 pp. Dec. 14	3,000
No. 105. Baby Beef. Ernest G. Ritzman. 34 pp. Nov. 1, 500; Feb. 15, 1,000	1,500
No. 114. Sanitary Milk Production: Report of a Conference Appointed by the Commissioners of the District of Columbia, with Accompanying Papers. 38 pp. July 1, 3,000; Mar. 19, 2,500	5,500
No. 118. The Unsuspected but Dangerously Tuberculous Cow. E. C. Schroeder. 19 pp. June 22	2,000
No. 123. Instructions for Preparing and Shipping Pathological Specimens for Diagnosis. George H. Hart. 10 pp. Oct. 29	500
No. 124. Suggestions for Horse and Mule Raising in the South. George M. Rommel. 15 pp. Nov. 4	1,000
No. 125. The Federal Meat Inspection Service. A. D. Melvin. 40 pp. Dec. 6	2,000
No. 127. Tubercle Bacilli in Butter: Their Occurrence, Vitality, and Significance. E. C. Schroeder and W. E. Cotton. 23 pp. June 4	1,000
No. 128. White Diarrhea of Chicks, with Notes on Coccidiosis in Birds. Byron Morse. 7 pp. Mar. 26	1,000
No. 129. Rabies and its Increasing Prevalence. George H. Hart. 26 pp. Mar. 26	1,000
No. 131. Designs for Dairy Buildings. Ed. H. Webster. 26 pp. Sept. 28, 3,000; Mar. 24, 3,000	6,000
No. 132. A Practical Method for the Detection of Beef Fat in Lard. James A. Emery. 9 pp. Nov. 4	500
No. 134. Classified List of Available Publications of the Bureau of Animal Industry. 8 pp. Sept. 20, 4,000; Apr. 4, 1,500	5,500
No. 136. How to Build a Stave Silo. B. A. Rawl. 18 pp. Mar. 23	3,000
No. 139. The Score-Card System of Dairy Inspection. Clarence B. Lane and George M. Whitaker. 32 pp. July 6, 2,000; Mar. 14, 2,000	4,000
No. 140. The Egg Trade of the United States. Milo M. Hastings. 34 pp. July 17, 2,000; July 26, 3,000	5,000
No. 142. Some Important Factors in the Production of Sanitary Milk. Ed H. Webster. 22 pp. Aug. 4, 1,000; Dec. 6, 2,000	3,000
No. 143. Milk and its Products as Carriers of Tuberculosis Infection. E. C. Schroeder. 22 pp. Nov. 2	4,000
No. 144. Tuberculosis of Hogs: Its Cause and Suppression. John R. Mohler and Henry J. Washburn. 36 pp. Aug. 27	2,000
Farmers' Bulletins:	
No. 24. Hog Cholera and Swine Plague. D. E. Salmon. 15 pp. Oct. 9	10,000
No. 42. Facts about Milk. R. A. Pearson. 32 pp. Feb. 2, 10,000; Apr. 11, 10,000	20,000
No. 51. Standard Breeds of Chickens. George E. Howard. (Revised by G. Arthur Bell.) 48 pp. Nov. 11, 15,000; Jan. 29, 15,000; Feb. 23, 25,000; May 20, 20,000	75,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF ANIMAL INDUSTRY—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

Farmers' Bulletins—Continued. Copies.

No. 55. The Dairy Herd: Its Formation and Management. Henry E. Alvord. 32 pp. Oct. 25, 10,000; Jan. 27, 10,000; Apr. 12, 10,000 ---------- 30,000

No. 63. Care of Milk on the Farm. R. A. Pearson. 40 pp. Aug. 7, 10,000; Dec. 6, 10,000; Feb. 1, 10,000; Apr. 5, 10,000 ---------- 40,000

No. 64. Ducks and Geese: Standard Breeds and Management. George E. Howard. 55 pp. Oct. 26, 10,000; Feb. 10, 10,000; May 10, 10,000 ---------- 30,000

No. 71. Some Essentials of Beef Production. Charles F. Curtiss. 24 pp. Mar. 10 ---------- 5,000

No. 96. Raising of Sheep for Mutton. Charles F. Curtiss. 48 pp. Feb. 19 ---------- 10,000

No. 100. Hog Raising in the South. S. M. Tracy. 40 pp. Sept. 15, 50,000; Dec. 28, 10,000; Feb. 23, 10,000; Mar. 29, 5,000; June 10, 10,000 ---------- 85,000

No. 106. Breeds of Dairy Cattle. Henry E. Alvord. 48 pp. Oct. 29, 10,000; Feb. 16, 10,000; May 16, 15,000; Apr. 19, 20,000 ---------- 55,000

No. 137. The Angora Goat. George Fayette Thompson. (Revised by Edward L. Shaw.) 48 pp. Nov. 1, 10,000; May 20, 10,000 ---------- 20,000

No. 152. Scabies of Cattle. Richard W. Hickman. 32 pp. Oct. 30, 10,000; June 15, 10,000 ---------- 20,000

No. 159. Scab in Sheep. D. E. Salmon and Ch. Wardell Stiles. 48 pp. Aug. 18, 10,000; Sept. 20, 10,000; Mar. 10, 5,000 ---------- 25,000

No. 166. Cheese Making on the Farm. Henry E. Alvord. 16 pp. Oct. 18, 5,000; Feb. 14, 10,000 ---------- 15,000

No. 177. Squab Raising. William E. Rice. 31 pp. Nov. 1, 10,000; Mar. 8, 10,000 ---------- 20,000

No. 179. Horseshoeing. John W. Adams. 32 pp. Feb. 26, 10,000; May 16, 10,000 ---------- 20,000

No. 183. Meat on the Farm: Butchering, Curing, and Keeping. Andrew Boss. 38 pp. Oct. 21, 10,000; Dec. 10, 10,000; Feb. 23, 10,000; Apr. 13, 10,000; May 19, 10,000 ---------- 50,000

No. 200. Turkeys: Standard Varieties and Management. T. F. McGraw. 40 pp. Nov. 4, 15,000; Feb. 19, 15,000; May 6, 15,000 ---------- 45,000

No. 201. The Cream Separator on Western Farms. Ed. H. Webster and C. E. Gray. 23 pp. Oct. 2, 5,000; Apr. 7, 5,000 ---------- 10,000

No. 205. Pig Management. George M. Rommel. 48 pp. Sept. 2, 10,000; Nov. 8, 15,000; Mar. 8, 15,000; May 27, 15,000 ---------- 55,000

No. 206. Milk Fever: Its Simple and Successful Treatment. John R. Mohler. 15 pp. July 15, 10,000; Jan. 3, 5,000; Feb. 14, 5,000; May 26, 10,000 ---------- 30,000

No. 236. Incubation and Incubators. Richard H. Wood. 31 pp. Mar. 3, 10,000; Apr. 7, 15,000; June 14, 15,000 ---------- 40,000

No. 241. Butter Making on the Farm. Ed. H. Webster. 31 pp. Oct. 30, 15,000; Mar. 10, 20,000; June 6, 15,000 ---------- 50,000

No. 258. Texas or Tick Fever and Its Prevention. John R. Mohler. 47 pp. May 21 ---------- 15,000

No. 261. The Cattle Tick in its Relation to Southern Agriculture. August Mayer. 22 pp. July 26 ---------- 10,000

No. 287. Poultry Management. G. Arthur Bell. 48 pp. Aug. 18, 10,000; Oct. 26, 15,000; Feb. 4, 20,000; Mar. 15, 20,000; Apr. 8, 50,000; June 9, 15,000 ---------- 130,000

No. 345. Some Common Disinfectants. M. Dorset. 14 pp. Sept. 25, 5,000; Jan. 13, 10,000 ---------- 15,000

No. 346. The Computation of Rations for Farm Animals by the Use of Energy Values. Henry Prentiss Armsby. 32 pp. Jan. 7, 10,000; Apr. 27, 10,000; June 14, 10,000 ---------- 30,000

No. 348. Bacteria in Milk. L. A. Rogers. 24 pp. Dec. 29 ---------- 15,000

No. 349. The Dairy Industry in the South. B. H. Rawl, Duncan Stewart, and George M. Whitaker. 40 pp. Jan. 7, 10,000; Mar. 5, 10,000 ---------- 20,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF ANIMAL INDUSTRY—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

	Copies.
Farmers' Bulletins—Continued.	
No. 350. The Dehorning of Cattle. Richard W. Hickman. 16 pp. Dec. 9, 10,000; Mar. 5, 10,000	20,000
No. 351. The Tuberculin Test of Cattle for Tuberculosis. John R. Mohler. 8 pp. Oct. 21, 10,000; May 17, 10,000	20,000
No. 357. Methods of Poultry Management at the Maine Agricultural Experiment Station. Raymond Pearl. 39 pp. July 1, 5,000; July 7, 20,000; Sept. 10, 15,000; Feb. 21, 15,000; May 9, 40,000	95,000

BUREAU OF BIOLOGICAL SURVEY.

NEW PUBLICATIONS.

North American Fauna:	
No. 29. The Rabbits of North America. E. W. Nelson. 314 pp. 50 cts. Aug. 31	1,000
No. 30. Biological Investigation in Alaska and Yukon Territory. Wilfred H. Osgood. 96 pp. 15 cts. Oct. 7	3,000
Circulars:	
No. 70. Directory of Officials Concerned with the Protection of Birds and Game, 1909. 16 pp. Aug. 16	5,000
No. 71. National Bird and Mammal Reservations in Alaska in Charge of the U. S. Department of Agriculture. 15 pp. Apr. 12	1,600
No. 72. Private Game Preserves and Their Future in the United States. T. S. Palmer. 11 pp. May 5	5,000
No. 73. Progress in Game Protection in 1909. T. S. Palmer, Henry Oldys, and C. E. Brewster. 19 pp. May 23	5,000
Annual Report:	
Report of the Chief of the Bureau for 1909. C. Hart Merriam. (From An. Rpts. of Dept., 1909.) 23 pp. Nov. 20	2,500
Yearbook Extracts:	
No. 474. The Economic Value of Predaceous Birds and Mammals. A. K. Fisher. (From Ybk. 1908.) 10 pp. Aug. 17	5,000
No. 482. Mouse Plagues, Their Control and Prevention. Stanley E. Piper. (From Ybk. 1908.) 13 pp. Aug. 25	5,000
No. 486. The Relations between Birds and Insects. F. E. L. Beal. (From Ybk. 1908.) 8 pp. July 19, 2,500; Feb. 1, 3,000	5,500
No. 491. Use of Poisons for Destroying Noxious Mammals. David E. Lantz. (From Ybk. 1908.) 12 pp. July 27	5,000
No. 500. Progress of Game Protection in 1908. T. S. Palmer. (From Ybk. 1908.) 12 pp. Sept. 7	5,000
No. 504. Plants Useful to Attract Birds and Protect Fruit. W. L. McAtee. (From Ybk. 1909.) 16 pp. June 24	3,000
No. 506. Pocket Gophers as Enemies of Trees. David E. Lantz. (From Ybk. 1909.) 12 pp. June 24	3,000
No. 510. Introduction of the Hungarian Partridge Into the United States. Henry Oldys. (From Ybk. 1909.) 12 pp. May 23	3,000
Farmers' Bulletins:	
No. 369. How to Destroy Rats. David E. Lantz. 60 pp. Sept. 3, 20,000; Oct. 28, 10,000; Jan. 7, 15,000; Apr. 12, 5,000; June 10, 10,000	60,000
No. 376. Game Laws for 1909. A summary of the Provisions Relating to Seasons, Shipments, Sale, Limits, and License. T. S. Palmer, Henry Oldys, and C. E. Brewster. 56 pp. Oct. 2, 30,000; Nov. 29, 20,000; Feb. 16, 10,000	60,000
No. 383. How to Destroy English Sparrows. T. S. Palmer and Henry Oldys. 30 pp. Jan. 18, 20,000; Mar. 12, 10,000; June 1, 15,000	45,000
No. 390. Pheasant Raising in the United States. Henry Oldys. With a Chapter on Diseases of Pheasants by George Byron Morse. 40 pp. Apr. 19, 15,000; June 11, 10,000	25,000
No. 396. The Muskrat. David E. Lantz. 38 pp. Apr. 30	15,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF BIOLOGICAL SURVEY—Continued.

EARLIER PUBLICATIONS REPRINTED.

	Copies.
Bulletins:	
No. 17. Birds of a Maryland Farm. A Local Study of Economic Ornithology. Sylvester D. Judd. 116 pp. 5 cts. Dec. 29	1,000
No. 33. The Brown Rat in the United States. David E. Lantz. 54 pp. 15 cts. Aug. 11	1,500
North American Fauna:	
No. 27. A Biological Investigation of the Athabaska-MacKenzie Region. Edward A. Preble. 574 pp. 80 cts. Sept. 30	1,000
Circulars:	
No. 66. The Alaska Game Law and Regulations of the Department of Agriculture, 1908. 8 pp. Nov. 24	1,000
No. 68. Regulations for the Protection of Deer in Alaska. 1 p. Aug. 28	500
Yearbook Extracts:	
No. 133. Birds as Weed Destroyers. Sylvester D. Judd. (From Ybk. 1898.) 14 pp. June 27	1,000
No. 197. How Birds Affect the Orchard. F. E. L. Beal. (From Ybk. 1900.) 16 pp. Dec. 6, 1,500; June 22, 1,000	2,500
No. 309. The Economic Value of the Bobwhite. Sylvester D. Judd. (From Ybk. 1903.) 16 pp. Aug. 10, 1,000; Apr. 6, 1,000	2,000
No. 416. Birds that Eat Scale Insects. W. L. McAtee. (From Ybk. 1906.) 12 pp. Mar. 15	1,000
Farmers' Bulletins:	
No. 54. Some Common Birds in Their Relation to Agriculture. F. E. L. Beal. 48 pp. Oct. 28, 10,000; Feb., 10,000; June 4, 5,000	25,000
No. 197. Importation of Game Birds and Eggs for Propagation. T. S. Palmer and Henry Oldys. 30 pp. Jan. 15	5,000
No. 328. Silver Fox Farming. Wilfred H. Osgood. 24 pp. Feb. 8, 5,000; May 20, 5,000	10,000
No. 330. Deer Farming in the United States. David E. Lantz. 20 pp. June 6	10,000
No. 335. Harmful and Beneficial Mammals of the Arid Interior, with Special Reference to the Carson and Humboldt Valleys, Nevada. Vernon Bailey. 31 pp. June 6	10,000

BUREAU OF CHEMISTRY.

NEW PUBLICATIONS.

Bulletins:	
No. 126. The Harmful Effects of Acetanilid, Antipyrin, and Phenacetin. L. F. Kebler, F. P. Morgan, and Philip Ruff. 85 pp. 10 cts. July 6, 2,500; Dec. 4, 500	3,000
No. 127. The Influence of Environment on the Composition of Sweet Corn, 1905–1908. M. N. Straughn and G. C. Church. 69 pp. 10 cts. Dec. 1	2,500
No. 128. Tri-local Experiments on the Influence of Environment on the Composition of Wheat. J. A. LeClerc and Sherman Leavitt. 18 pp. 5 cts. Apr. 21	2,500
No. 129. Enological Studies. I. Experiments in Cider Making Applicable to Farm Conditions. II. Notes on the Use of Pure Yeasts in Wine Making. William B. Alwood. 32 pp. 5 cts. Nov. 12	2,300
No. 130. Manufacture of Denatured Alcohol Based on an Experimental Still at Washington, D. C., and a Course of Lectures Delivered in Connection Therewith. H. W. Wiley, H. E. Sawyer, L. M. Tolman, A. H. Bryan, A. Given, and H. W. Berger. 166 pp. 20 cts. Jan. 20	1,000
No. 131. Lead Arsenate. I. Composition of Lead Arsenates Found on the Market. II. "Home-made" Lead Arsenate and the Chemicals Entering into Its Manufacture. III. Action of Lead Arsenate on Foliage. J. K. Haywood and C. C. McDonnell, in Cooperation with the Bureau of Entomology. 50 pp. 15 cts. Apr. 7	2,200

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF CHEMISTRY—Continued.

NEW PUBLICATIONS—Continued.

	Copies.
Bulletins—Continued.	
No. 132. Proceedings of the Twenty-sixth Annual Convention, Association of Official Agricultural Chemists, Denver, Colo., Aug. 26–28, 1910. Edited by H. W. Wiley, Secretary of the Association. 218 pp. 25 cts. June 22	1,000
Circulars:	
No. 44. Apparatus for Use in the Determination of Volatile Acids in Wines and Vinegar. H. C. Gore. 2 pp. Aug. 17, 800; Nov. 26, 500	1,300
No. 45. A New Method for Measuring the Electrolytic Dissociation of Water. C. S. Hudson. 2 pp. Sept. 3, 2,500; Jan. 6, 500	3,000
No. 46. The Occurrence of Pinene in Lemon Oil. E. M. Chace. 24 pp. Oct. 30, 2,300; Jan. 10, 500	2,800
No. 47. The Hydrolysis of Salicin by the Enzym Emulsin. C. S. Hudson and H. S. Paine. 8 pp. Nov. 8	2,200
No. 48. The Cold Storage of Apple Cider. H. C. Gore. 13 pp. Jan. 29	3,500
No. 49. The Relation Between the Chemical Constitution and the Optical Rotation Power of the Sugar Lactones. C. S. Hudson. 8 pp. Jan. 24	2,100
No. 50. The Quantitative Determination of Cane Sugar by the Use of Invertase. C. S. Hudson. 8 pp. Feb. 3	2,000
No. 51. The Value of Peaches as Vinegar Stock. H. C. Gore. 7 pp. Feb. 26	2,500
No. 52. Extracts from Proceedings of the Association of Official Agricultural Chemists, 1909. Report on the Recommendations of Referees. J. K. Haywood. 32 pp. Mar. 3	2,700
No. 53. Suggested Modification of the Winton Lead Number, especially as Applied to Mixtures of Maple and Cane Sirups. S. M. Ross. 9 pp. Mar. 9	2,000
No. 54. Analysis of Canned Peas and Beans, showing Composition of Different Grades. W. L. Dubois. 9 pp. Mar. 28	2,500
No. 55. Influence of Acids and Alkalis on the Activity of Invertase. C. S. Hudson and H. S. Paine. 7 pp. Apr. 22	2,200
No. 56. The Determination of Total Sulphur in Organic Matter. Herman Schreiber. 9 pp. June 15	2,500
No. 57. Experiments on the Preparation of Sugared Dried Pineapples. H. C. Gore. 8 pp. May 16	2,500
No. 59. The Destruction of the Enzym Invertase by Acids, Alkalis, and Hot Water. C. S. Hudson and H. S. Paine. 5 pp. June 24	2,500
Annual Report:	
Report of the Chemist for 1909. H. W. Wiley. (From An. Repts. of Dept. 1909.) 61 pp. Dec. 9, 1,500; Apr. 12, 500	2,000
Yearbook Extracts and Separates:	
No. 479. Suitable Paper for Permanent Records. F. P. Veitch. (From Ybk. 1908.) 10 pp. July 17	1,000
No. 485. The Manufacture of Flavoring Extracts. E. M. Chace. (From Ybk. 1908.) 2 pp. Aug. 17, 800; Nov. 6, 500; Feb. 3, 1,000	2,300
No. 489. Plant Food Removed from Growing Plants by Rain or Dew. J. A. LeClerc and J. F. Breazeale. (From Ybk. 1908.) 16 pp. July 27	500
The Effect of Distillation in Different Types of Stills. L. M. Tolman. (From Bul. 130, Bu. of Chem.) 7 pp. Jan. 20	100
Farmers' Bulletins:	
No. 377. Harmfulness of Headache Mixtures. L. F. Kebler, F. P. Morgan, and Philip Rupp. 16 pp. Sept. 28, 10,000; Dec. 10, 15,000; Mar. 8, 15,000; Apr. 4, 15,000	55,000
No. 393. Habit-forming Agents: Their Indiscriminate Sale and Use a Menace to the Public Welfare. L. F. Kebler. 19 pp. Apr. 29, 20,000; May 31, 30,000	50,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF CHEMISTRY—Continued.

EARLIER PUBLICATIONS REPRINTED.

	Copies.
Bulletins:	
No. 84. Influence of Food Preservatives and Artificial Colors on Digestion and Health. Part I. Boric Acid and Borax. H. W. Wiley, with the cooperation of W. D. Bigelow, F. C. Weber, and Others. 477 pp. 30 cts. July 20	250
No. 84. *Same.* Part V. Formaldehyde. H. W. Wiley, with the cooperation of W. D. Bigelow, F. C. Weber, and Others 212 pp. 25 cts. July 30	300
No. 98 (Revised). Part I. Drug Legislation in the United States. L. F. Kebler. 340 pp. 35 cts. July 26	300
No. 107. Official and Provisional Methods of Analysis, Association of Official Agricultural Chemists. As Compiled by the Committee on Revision of Methods (J. K. Haywood, J. P. Street, F. W. Woll, J. H. Pettit, L. M. Tolman, F. P. Veitch, and A. L. Winton.) Nov. 1, 1906, and provisionally adopted by the association. Edited by H. W. Wiley, Secretary of the Association. 272 pp. 20 cts. Feb. 19	300
No. 109. Some Technical Methods of Testing Miscellaneous Supplies, including Paints and Paint Materials, Inks, Lubricating Oils, Soaps, etc. Percy H. Walker. 68 pp. 10 cts. Mar. 1	2,200
No. 115. A Preliminary Study of the Effects of Cold Storage on Eggs, Quail, and Chickens. H. W. Wiley, with the Collaboration of M. E. Pennington, G. W. Stiles, Jr., H. B. Howard, and F. C. Cook. 117 pp. 10 cts. Apr. 5	500
No. 118. Unfermented Apple Juice. H. C. Gore. 23 pp. 5 cts. Dec. 16	250
No. 122. Proceedings of the Twenty-fifth Annual Convention of the Association of Official Agricultural Chemists, Held at Washington, D. C., Nov. 12–16, 1908. Edited by H. W. Wiley, Secretary of the Association. 248 pp. 40 cts. Aug. 23	500
Circulars:	
No. 14. Organization of the Bureau of Chemistry. Revised to July 1, 1909. 29 pp. Oct. 12	3,000
No. 16. Officials Charged with the Enforcement of Food Laws in the United States and Canada. Revised to July 1, 1909. 37 pp. Nov. 13	2,700
No. 35. Report on Colors: The Solubility and Extraction of Colors and the Color Reaction of Dyed Fiber and of Aqueous and Sulphuric-acid Solutions. H. M. Loomis. 51 pp. Jan. 10	500
Yearbook Extracts:	
No. 328. Determination of Effect of Preservatives in Foods on Health and Digestion. H. W. Wiley. (From Ybk. 1903.) 16 pp. Oct. 26	100
No. 331. Adulteration of Drugs. Lyman F. Kebler. (From Ybk. 1903.) 12 pp. Oct. 26	100
Farmers' Bulletins:	
No. 52. The Sugar Beet: Culture, Seed Development, Manufacture, and Statistics. H. W. Wiley. (3d Revision, by A. Hugh Bryan.) 47 pp. Oct. 15, 5,000; Jan. 28, 5,000; Apr. 23, 5,000	15,000
No. 131. Household Tests for the Detection of Oleomargarine and Renovated Butter. G. E. Patrick. 10 pp. Sept. 18, 5,000; Jan. 29, 5,000; June 15, 10,000	20,000
No. 135. Sorghum Sirup Manufacture. A. A. Denton. 39 pp. Oct. 9, 5,000; Feb. 17, 5,000; Apr. 30, 10,000	20,000
No. 268. Industrial Alcohol: Sources and Manufacture. H. W. Wiley. 45 pp. Jan. 7	5,000
No. 269. Industrial Alcohol: Uses and Statistics. H. W. Wiley. 29 pp. Aug. 11, 5,000; Jan. 15, 5,000; May 11, 10,000	20,000
No. 359. Canning Vegetables in the Home. J. F. Breazeale. 16 pp. Aug. 6, 20,000; Feb. 4, 15,000; Feb. 26, 20,000; Apr. 28, 30,000	85,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF ENTOMOLOGY.

NEW PUBLICATIONS.

Bulletins:	Copies.
No. 58. Some Insects Injurious to Forests. Part IV. The Southern Pine Sawyer. J. L. Webb. 16 pp. 5 cts. Nov. 11	2,000
No. 58. *Same.* Part V. Insect Depredations in North American Forests, and Practical Methods of Prevention and Control. 45 pp. 10 cts. Dec. 3	2,000
No. 63. Papers on the Cotton Boll Weevil and Related and Associated Insects. 71 pp. 15 cts. Sept. 20	1,000
No. 63. *Same.* Part [VIII]. Supplement. Index to Papers on Cotton Boll Weevil and Related and Associated Insects. 5 pp. 5 cts. July 17	3,000
No. 64. Some Miscellaneous Results of the Work of the Bureau of Entomology. Part VI. The Greenhouse Thrips. H. M. Russell. 18 pp. 5 cts. Aug. 4	2,000
No. 64. *Same.* Part VII. New Breeding Records of the Coffee-bean Weevil. E. S. Tucker. 4 pp. 5 cts. Aug. 6	2,000
No. 64. *Same.* Part VIII. The Woolly White-Fly: A New Enemy of the Florida Orange. E. A. Back. 12 pp. 5 cts. May 9	2,000
No. 66. Some Insects Injurious to Truck Crops. Part VII. Miscellaneous Notes on Truck Crop Insects. F. H. Chittenden. 5 pp. 5 cts. July 20	2,000
No. 66. *Same.* Part [VIII]. Contents and Index. 10 pp. 5 cts. Mar. 19	2,000
No. 68. Papers [9] on Deciduous-fruit Insects and Insecticides. 117 pp. 25 cts. Nov. 2	1,000
No. 68. *Same.* Part I. The Pear Thrips. Dudley Moulton. 16 pp. 10 cts. Sept. 20	2,000
No. 68. *Same.* Part [X]. Contents and Index. 9 pp. 5 cts. Sept. 20	2,000
No. 77. Hibernation of the Mexican Cotton Boll Weevil. W. E. Hinds and W. W. Yothers, under the direction of W. D. Hunter. 100 pp. 25 cts. Oct. 19	2,000
No. 77. *Same.* [Supplement.] Contents and Index. 6 pp. 5 cts. Oct. 28	2,000
No. 80. Papers on Deciduous-fruit Insects and Insecticides. Part II. The Cigar Case-bearer. A. G. Hammar. 44 pp. 10 cts. July 2	2,000
No. 80. *Same.* Part III. Additional Observations on the Lesser Apple Worm. S. W. Foster and P. R. Jonas. 10 pp. 5 cts. Aug. 12	2,000
No. 80. *Same.* Part IV. The Pear Thrips and Its Control. Dudley Moulton. 20 pp. 10 cts. Oct. 30	2,000
No. 81. A List of Works on North American Entomology. Nathan Banks. 120 pp. 15 cts. Jan. 18	1,000
No. 82. Some Insects Injurious to Truck Crops. Part I. The Colorado Potato Beetle in Virginia in 1908. C. H. Popenoe. 8 pp. 5 cts. Nov. 5	1,000
No. 82. *Same.* Part II. The Parsnip Leaf-Miner. The Parsley Stalk Weevil. The Celery Caterpillar. F. H. Chittenden. 24 pp. 5 cts. Nov. 30	2,000
No. 82. *Same.* Part III. The Lima-bean Pod Borer. The Yellow-necked Flea-beetle. F. H. Chittenden. 12 pp. 5 cts. Dec. 29	2,000
No. 82. *Same.* Part IV. The Life History and Control of the Hop Flea-beetle. William H. Parker. 30 pp. 10 cts. May 23	2,000
No. 83. Practical Information on the Scolytid Beetles of North American Forests. Part I. Barkbeetles of the Genus Dendroctonus. A. D. Hopkins. 169 pp. 25 cts. Oct. 12	1,000
No. 84. Fumigation of Apples for the San Jose Scale. A. L. Quaintance. 43 pp. 20 cts. Sept. 30	3,000
No. 85. Papers on Cereal and Forage Insects. Part I. The Lesser Clover-leaf Weevil. F. M. Webster. 12 pp. 5 cts. Nov. 18	2,000

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No. 85. *Same.* Part III. The Clover-root Curculio. V. L. Wildemuth. 14 pp. 5 cts. Mar. 7	3,000
No. 85. *Same.* Part IV. The Sorghum Midge. W. Harper Dean. 24 pp. 5 cts. May 24	2,000
No. 85. *Same.* Part V. The New Mexico Range Caterpillar. C. N. Ainslie. 42 pp. 5 cts. June 16	2,000
No. 86. Plant-bugs Injurious to Cotton Bolls. A. W. Merrill. 110 pp. 30 cts. June 17	2,000
No. 88. Preventive and Remedial Work Against Mosquitoes. L. O. Howard. 126 pp. 15 cts. June 21	1,000
Bulletins—Technical Series:	
No. 12. Part IX. A New Genus of Aleyrodidæ, with remarks on *Aleyrodes nubifera* Berger and *Aleyrodes Citri* Riley and Howard. A. L. Quaintance. 8 pp. 5 cts. Sept. 1	2,000
No. 16. Part III. Catalogue of Recently Described Coccidæ—II. J. G. Sanders. 28 pp. 5 cts. Dec. 22	2,000
No. 17. Part I. Contributions toward a Monograph of the Scolytid Beetles. I. The Genus Dendroctonus. A. D. Hopkins. 164 pp. 25 cts. July 13, 1,000; Dec. 10, 500	1,500
No. 18. The Anatomy of the Honey Bee. R. E. Snodgrass. 162 pp. 20 cts. May 31	1,000
No. 19. Part I. Technical Results from the Gipsy Moth Parasite Laboratory. I. The Parasites Reared or Supposed to have been Reared from the Eggs of the Gipsy Moth. L. O. Howard. 12 pp. 5 cts. Jan. 28	2,000
No. 19. Part II. Descriptions of Certain Chalcidoid Parasites. J. C. Crawford. 22 pp. 10 cts. Apr. 30	2,000
Circulars:	
No. 109. The Leopard Moth (*Zeuzera pyrina Fab.*). F. H. Chittenden. 8 pp. July 9	3,000
No. 110. The Green-striped Maple Worm (*Anisota rubicunda* Fab.). L. O. Howard and F. H. Chittenden. 7 pp. July 10	3,000
No. 111. Preparations for Winter Fumigation for the Citrus White Fly. A. W. Merrill and W. W. Yothers. 12 pp. Sept. 29	3,000
No. 112. Control of the Mediterranean Flour Moth by Hydrocyanic-acid Gas Fumigation. F. H. Chittenden. 22 pp. Nov. 1, 2,000; Mar. 8, 2,000; May 9, 2,000	6,000
No. 113. The Chinch Bug (*Blissus leucopterus* Say). F. M. Webster. 27 pp. Nov. 13, 3,000; Feb. 15, 1,000	4,000
No. 114. The Euonymus Scale (*Chionaspis euonymi* Comstock). J. G. Sanders. 5 pp. Nov. 24	2,000
No. 115. The Horn Fly (*Hæmatobia serrata* Rob.-Desv.). C. L. Marlatt. 13 pp. Apr. 15	2,000
No. 116. The Larger Corn Stalk-borer (*Diatræa saccharalis* Fab.). George G. Ainslee. 8 pp. Feb. 7	3,000
No. 117. The Western Grass-stem Sawfly (*Cephus occidentalis* Riley and Marlatt). F. M. Webster. 6 pp. Feb. 25	2,000
No. 118. A Predaceous Mite Proves Noxious to Man. F. M. Webster. 24 pp. Apr. 25	2,000
No. 119. The Clover Root-borer. F. M. Webster. 5 pp. Mar. 23	2,000
No. 120. The Control of the Brown-rot and Plum Curculio on Peaches. A. L. Quaintance. 7 pp. Mar. 14	8,500
No. 121. The Oyster-shell Scale and the Scurfy Scale. A. L. Quaintance and E. R. Sasscer. 15 pp. Apr. 30	2,000
No. 123. Methods of Controlling Tobacco Insects. A. C. Morgan. 17 pp. June 10	2,000
Annual Report:	
Report of the Entomologist for 1909. L. O. Howard. (From An. Rpts. of Dept., 1909.) 56 pp. Oct. 15	1,500

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF ENTOMOLOGY—Continued.

NEW PUBLICATIONS—Continued.

	Copies.
Yearbook Extracts and Separates:	
No. 480. Information about Spraying for Orchard Insects. A. L. Quaintance. (From Ybk. 1908.) 23 pp. Nov. 24, 1,000; Feb. 3, 2,000; June 27, 3,000	6,000
No. 499. The Principal Injurious Insects of the Year 1908. (From Ybk. 1908.) 16 pp. Sept. 3	500
No. 523. Injuries to Forest Trees by Flat-headed Borers. H. E. Burke. (From Ybk. 1909.) 20 pp. June 22	1,500
Practical Information on the Dendroctonus Enemies of North American Forests. A. D. Hopkins. (From Bul. 83, Part I.) 41 pp. Dec. 29	3,000
The Western Pine Beetle. The Southwestern Pine Beetle. The Round-headed Pine Beetle. A. D. Hopkins. (From Bul. 83, Part I.) 16 pp. Dec. 30	1,000
The Southern Pine Beetle. A. D. Hopkins. (From Bul. 83, Part I.) 18 pp. Dec. 15	2,000
The Arizona Pine Beetle. The Smaller Mexican Pine Beetle. The Larger Mexican Pine Beetle. The Colorado Pine Beetle. A. D. Hopkins. (From Bul. 83, Part I.) 9 pp. Dec. 30	1,000
The Mountain Pine Beetle. The Black Hills Beetle. The Jeffrey Pine Beetle. A. D. Hopkins. (From Bul. 83, Part I.) 24 pp. Dec. 14	2,000
The Eastern Larch Beetle. The Douglas Fir Beetle. A. D. Hopkins. (From Bul. 83, Part I.) 14 pp. Oct. 11	1,000
The Eastern Spruce Beetle. The Engelmann Spruce Beetle. The Alaska Spruce Beetle. The Sitka Spruce Beetle. A. D. Hopkins. (From Bul. 83, Part I.) 24 pp. Dec. 30	1,000
The Redwinged Pine Beetle. The Lodgepole Pine Beetle. The Allegheny Spruce Beetle. (From Bul. 83, Part I.) 12 pp. Dec. 15	500
The Black Turpentine Beetle. The Red Turpentine Beetle. A. D. Hopkins. (From Bul. 83, Part I.) 21 pp. Dec. 30	1,000
Miscellaneous Circulars:	
List of the Bulletins and Circulars of the Bureau. 8 pp. Aug. 9	10,000
List of Publications Relating to Bee Culture. 4 pp. Nov. 1	7,000
Circular Letter—Apiculture. 4 pp. Aug. 9	10,000
Farmers' Bulletins:	
No. 397. Bees. E. F. Phillips. 44 pp. June 15	20,000

EARLIER PUBLICATIONS REPRINTED.

Bulletins:	
No. 25, n. s. Notes on Mosquitoes of the United States: Giving Some Account of Their Structure and Biology, with Remarks on Remedies. L. O. Howard. 70 pp. 10 cts. Oct. 29	500
No. 80. Papers on Deciduous Fruit Insects and Insecticides. Part I. The Codling Moth in the Ozarks. E. L. Jenne. 32 pp. 10 cts. Nov. 18	2,000
Circulars:	
No. 7. The Pear-tree Psylla (*Psylla pyricola* Foerst.). C. L. Marlatt. 8 pp. July 17	3,000
No. 9. Cankerworms (*Paleacrita vernata* Peck and *Alsophila* (*Anisopteryx*) *pometaria* Harr). D. W. Coquillett. 4 pp. Aug. 4	3,000
No. 11. Revised. The Rose Chafer (*Macrodactylus suspinosus* Fab.). F. H. Chittenden. 4 pp. July 8	2,000
No. 25. The Ox Warble (*Hypoderma lineata* Villers). C. L. Marlatt. 7 pp. Jan. 28	1,000
No. 31. The Striped Cucumber Beetle (*Diabrotica vittata* Fab.). F. H. Chittenden. 7 pp. Sept. 27	5,000
No. 49. The Silver Fish (*Lepisma saccharina* Linn.). C. L. Marlatt. 4 pp. July 28	3,000

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Circulars—Continued. Copies.

No. 50. The White Ant (*Termes flavipes* Koll.). C. L. Marlatt. 8 pp. Jan. 28 1,000

No. 52. The Lime, Sulphur, and Salt Wash. C. L. Marlatt. 8 pp. Aug. 28 500

No. 54. The Peach-tree Borer (*Sannina exitiosa* Say). C. L. Marlatt. 6 pp. Dec. 3 2,000

No. 71. House Flies (*Musca domestica* et al.). L. O. Howard. 9 pp. Mar. 28 10,000

No. 72. Key to the Known Larvæ of the Mosquitoes of the United States. Harrison G. Dyar. 6 pp. Aug. 5 3,000

No. 73. The Plum Curculio (*Conotrachelus nenuphar* Herbst). Fred Johnson and A. A. Girault. 10 pp. Nov. 13 1,000

No. 75. Requirements to be Complied with by Nurserymen or Others who make Interstate Shipments of Nursery Stock. A. F. Burgess. 6 pp. Aug. 6, 2,000; Dec. 11, 2,000 4,000

No. 76. Revised. List of Publications of the Bureau. Compiled by Mabel Colcord. 32 pp. Aug. 4, 10,000; Feb. 3, 3,000 13,000

No. 79. The Brood Disease of Bees. E. F. Phillips. 5 pp. Aug. 28, 5,000; Mar. 29, 10,000; May 5, 5,000 20,000

No. 80. The Melon Aphis (*Aphis gossypii* Glov.). F. H. Chittenden. 6 pp. Nov. 13 1,000

No. 92. Mites and Lice on Poultry. Nathan Banks. 8 pp. Nov. 5, 1,000; Jan. 14, 2,000; Apr. 6, 3,000 6,000

No. 96. The Catalpa Sphinx (*Ceratomia catalpæ* Bdv.). L. O. Howard and F. H. Chittenden. 7 pp. Jan. 29 1,000

No. 97. The Bagworm (*Thyridopteryx ephemeræformis* Haw.). L. O. Howard and F. H. Chittenden. 10 pp. Feb. 7 1,000

No. 103. The Harlequin Cabbage Bug (*Murgantia histrionica* Hahn). F. H. Chittenden. 10 pp. Dec. 17 2,000

No. 105. The Rose Slugs. F. H. Chittenden. 12 pp. Feb. 3 1,000

Yearbook Extracts and Separates:

No. 360. The Annual Loss Occasioned by Destructive Insects in the United States. C. L. Marlatt. (From Ybk. 1904.) 14 pp. Nov. 11 500

No. 396. Farm Practice in the Control of Field-crop Insects. F. M. Webster. (From Ybk. 1905.) 16 pp. Aug. 9 500

No. 460. The Codling Moth or Apple Worm. A. L. Quaintance. (From Ybk. 1907.) 19 pp. Nov. 22 2,000

The Corn Root-Aphis and Its Attendant Ant. S. A. Forbes. (From Bul. 60.) 11 pp. July 23 500

Farmers' Bulletins:

No. 47. Revised. Insects Affecting the Cotton Plant. L. O. Howard. 21 pp. Feb. 17 10,000

No. 59. Bee Keeping. Frank Benton. 47 pp. July 26, 10,000; Nov. 3, 10,000 20,000

No. 99. Three Insect Enemies of Shade Trees. L. O. Howard. 31 pp. Sept. 25, 5,000; Dec. 14, 5,000; Mar. 28, 5,000 15,000

No. 120. The Principal Insects Affecting the Tobacco Plant. L. O. Howard. 32 pp. May 16 10,000

No. 127. Important Insecticides: Directions for their Preparation and Use. C. L. Marlatt. 48 pp. July 10, 5,000; Aug. 29, 15,000; Apr. 14, 10,000 30,000

No. 132. The Principal Insect Enemies of Growing Wheat. C. L. Marlatt. 40 pp. Aug. 31, 10,000; Dec. 11, 5,000; Apr. 22, 10,000 25,000

No. 145. Carbon Bisulphid as an Insecticide. 30 pp. Feb. 24, 5,000; May 17, 10,000 15,000

No. 155. How Insects Affect Health in Rural Districts. L. O. Howard. 19 pp. Oct. 15, 5,000; Feb. 10, 10,000 15,000

No. 165. Silkworm Culture. Henrietta Aiken Kelly. 32 pp. Nov. 20, 5,000; Apr. 15, 5,000 10,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

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Farmers' Bulletins—Continued. Copies.

No. 172. Scale Insects and Mites on Citrus Trees. C. L. Marlatt. 44 pp. Feb. 26 — 5,000

No. 178. Insects Injurious to Cranberry Culture. John B. Smith. 31 pp. Mar. 3 — 5,000

No. 196. Usefulness of the American Toad. A. H. Kirkland. 16 pp. Mar. 5, 5,000; June 10, 2,500 — 7,500

No. 211. The Use of Paris Green in Controlling the Cotton Boll Weevil. W. D. Hunter. 24 pp. Apr. 13 — 5,000

No. 223. Miscellaneous Cotton Insects in Texas. Dwight Sanderson. 23 pp. Feb. 17 — 10,000

No. 264. The Brown-tail Moth and How to Control It. L. O. Howard. 24 pp. Dec. 14, 5,000; May 17, 5.000 — 10,000

No. 275. The Gipsy Moth and How to Control It. L. O. Howard. 24 pp. Aug. 3, 5,000; May 20, 5,000 — 10,000

No. 284. Insect and Fungous Enemies of the Grape East of the Rocky Mountains. A. L. Quaintance and C. L. Shear. 48 pp. Apr. 11 — 5,000

No. 290. The Cotton Bollworm: A Summary of Its Life History and Habits, with Some Results of Investigations in 1905 and 1906. F. C. Bishopp and C. R. Jones. 32 pp. Oct. 14, 10,000; Apr. 26, 10,000 — 20,000

No. 344. The Boll Weevil Problem with Special Reference to Means of Reducing Damage. W. D. Hunter. 48 pp. July 24, 5,000; Aug. 11, 10,000; Mar. 31, 15,000 — 30,000

OFFICE OF EXPERIMENT STATIONS.

NEW PUBLICATIONS.

Bulletins:

No. 212. Proceedings of the Twenty-second Annual Convention of the Association of American Agricultural Colleges and Experiment Stations, held at Washington, D. C., Nov. 18–20, 1908. Edited by A. C. True, W. H. Beal, and H. C. White. 122 pp. 15 cts. July 10 — 1,000

No. 213. Proceedings of the Thirteenth Annual Meeting of the American Association of Farmers' Institute Workers, held at Washington, D. C., Nov. 16–19, 1908. Edited by W. H. Beal and John Hamilton. 73 pp. 10 cts. July 10, 5,000; Dec. 11, 2,000 — 7,000

No. 216. Irrigation in Idaho. James Stephenson, Jr. 59 pp. 15 cts. Sept. 10 — 5,000

No. 217. Drainage of Irrigated Lands in the San Joaquin Valley, California. Samuel Fortier and Victor M. Cone. 58 pp. 15 cts. Sept. 27, 3,000; Jan. 8, 500 — 3,500

No. 219. Irrigation in North Dakota. T. R. Atkinson. 39 pp. 10 cts. Sept. 10 — 5,000

No. 220. Secondary Agricultural Education in Alabama. C. J. Owens. 30 pp. 10 cts. Nov. 19 — 5,000

No. 221. Dietary Studies in Rural Regions in Vermont, Tennessee, and Georgia. J. L. Hills, Charles E. Wait, and H. C. White. 142 pp. 25 cts. Dec. 23 — 1,000

No. 222. Irrigation in Texas. J. C. Nagel. 92 pp. 15 cts. Jan. 19 — 5,000

No. 223. Dietary Studies in Public Institutions in Philadelphia, Pa., by Miss Emma Smedley and R. D. Milner; and Dietary Studies in Public Institutions in Baltimore, Md., by H. L. Knight, H. A. Pratt, and C. F. Langworthy. 98 pp. 15 cts. Feb. 4 — 3,000

No. 224. Organization List of the Agricultural Colleges and Experiment Stations in the United States. 63 pp. 15 cts. Feb. 1 — 3,500

No. 225. Proceedings of the Fourteenth Annual Meeting of the Association of Farmers' Institute Workers, held at Portland, Oreg., August 16, 17, 1909. Edited by W. H. Beal and John Hamilton. 52 pp. 10 cts. May 5 — 6,000

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No. 226. Irrigation Experiments and Investigations in Western Oregon. A. P. Stover. 68 pp. 10 cts. June 8	5,000
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No. 85. Farmers' Institutes for Women. John Hamilton. 16 pp. Oct. 4, 5,200; Nov. 16, 5,000	10,200
No. 86. A Preliminary Report on the St. Francis Valley Drainage Project in Northwestern Arkansas. Arthur E. Morgan. 31 pp. Nov. 20	3,000
No. 87. Organization, Work, and Publications of Irrigation Investigations. 12 pp. Oct. 6, 2,000; Feb. 7, 1,000	3,000
No. 88. Organization, Work, and Publications of Drainage Investigations. 6 pp. Sept. 24, 5,000; Jan. 31, 5,000	10,000
No. 89. Organization, Work, and Publications of Food and Nutrition Investigations. 18 pp. Oct. 25	1,500
No. 90. Normal School Instruction in Agriculture. M. J. Abbey. 11 pp. Dec. 16	6,000
No. 91. Secondary Education in Agriculture in the United States. A. C. True. 11 pp. Nov. 8	10,000
No. 92. Progress Report on Experiments in Supplemental Irrigation with Small Water Supplies at Cheyenne and Newcastle, Wyoming, 1905–1908. O. W. Bryant. 51 pp. Jan. 12	3,000
No. 93. Organization, Work, and Publications of the Agricultural Education Service. 15 pp. Jan. 13	5,600
No. 94. Free Publications of the Department of Agriculture, Classified for the Use of Teachers. Dick J. Crosby and F. W. Howe. 29 pp. Feb. 28, 2,500; May 24, 2,500	5,000
No. 95. Experiments in Supplemental Irrigation with Small Water Supplies at Cheyenne, Wyo., in 1909. John H. Gordon. 11 pp. Apr. 7	5,000
No. 96. How to Test Seed Corn in Schools. 7 pp. Apr. 9	18,000
No. 97. Institutions in the United States Giving Instruction in Agriculture. 15 pp. May 23	7,500
Experiment Station Record.[a] (A monthly review devoted mainly to the State Agricultural Experiment Stations):	
Vol. XX, No. 12, June 1909. 112 pp. July 24	7,500
Vol. XX, Name Index Number. 44 pp. Sept. 27	7,500
Vol. XX, Subject Index Number. 115 pp. Oct. 9	7,500
Vol. XXI, No. 1, July, 1909. 110 pp. Aug. 4	7,500
Vol. XXI, No. 2 August, 1909. 110 pp. Sept. 8	7,500
Vol. XXI, No. 3, September, 1909. 109 pp. Sept. 18	7,500
Vol. XXI, No. 4, Abstract Number. 110 pp. Oct. 2	7,500
Vol. XXI, No. 5, October, 1909. 114 pp. Nov. 3	7,500
Vol. XXI, No. 6, November, 1909. 111 pp. Nov. 13	7,500
Vol. XXI, No. 7, December, 1909. 109 pp. Dec. 11	7,500
Vol. XXI, No. 8, Abstract Number. 109 pp. Dec. 18	7,500
Vol. XXI, Index Number. 124 pp. May 3	7,500
Vol. XXII, No. 1, January, 1910. 108 pp. Jan. 24	7,500
Vol. XXII, No. 2, February, 1910. 109 pp. Feb. 21	7,500
Vol. XXII, No. 3, March, 1910. 109 pp. Mar. 14	7,500
Vol. XXII, No. 4, Abstract Number. 109 pp. Mar. 29	7,500
Vol. XXII, No. 5, April, 1910. 108 pp. Apr. 27	7,500
Vol. XXII, No. 6, May, 1910. 109 pp. May 13	7,500
Vol. XXII, No. 7, June, 1910. 109 pp. June 21	7,500
Vol. XXII, No. 8, Abstract Number. 109 pp. June 30	7,500

[a] Price per volume of 8 numbers with indexes, $1, payable in advance; no single copies sold.

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	Copies.
Annual Reports:	
Annual Report of the Alaska Agricultural Experiment Station for the Year ended June 30, 1908. C. C. Georgeson. 80 pp. July 9	5,000
Annual Report of the Director of the Office of Experiment Stations for 1909. A. C. True. (From An. Rpts. of Dept., 1909.) 31 pp. Nov. 10	2,500
Farmers' Institute Lecture:	
No. 11. Syllabus of Illustrated Lecture on Wheat Culture. J. I. Schulte. 22 pp. Mar. 29	3,000
Yearbook Extracts and Separates:	
No. 495. Soil Mulches for Checking Evaporation. Samuel Fortier. (From Ybk. 1908.) 10 pp. July 23, 1,000; Nov. 13, 1,000	2,000
No. 514. Methods of Applying Water to Crops. Samuel Fortier. (From Ybk. 1909.) 20 pp. June 23	3,000
Doc. 1183. Rural versus Urban Conditions in the Determination of Educational Policy. Andrew Sledd. (From Bulletin No. 212, O. E. S.) 7 pp. July 2	1,200
Doc. 1185. Bovine Tuberculosis and Methods for Its Control. V. A. Moore. (From Bulletin 212, O. E. S.) 7 pp. July 19	100
Doc. 1216. Work and Expenditures of the Agricultural Experiment Stations for the Year ended June 30, 1908. E. W. Allen. (From An. Rpt., O. E. S., 1908.) 41 pp. Nov. 3	1,000
Doc. 1217. Statistics of Land-Grant Colleges and Experiment Stations, 1908. Compiled by M. T. Spethman. (From An. Rpt., O. E. S., 1908.) 43 pp. Oct. 25	1,000
Doc. 1218. Progress in Agricultural Education, 1908. Dick J. Crosby. (Rrom An. Rpt., O. E. S., 1908.) 62 pp. Nov. 8	6,000
Doc. 1219. The Farmers' Institutes in the United States, 1908. John Hamilton. (From An. Rpt., O. E. S., 1908.) 51 pp. Oct. 23	6,000
Doc. 1220. Animal Nutrition Problems in Relation to the Work of the Experiment Stations. C. F. Langworthy. (From An. Rpt., O. E. S., 1908.) 20 pp. Oct. 23	500
Doc. 1221. Review of Ten Years of Irrigation Investigations. R. P. Teele. (From An. Rpt., O. E. S., 1908.) 55 pp. Oct 26	5,000
Doc. 1222. The Alluvial Lands of the Lower Mississippi Valley and Their Drainage. Arthur E. Morgan. (From An. Rpt., O. E. S., 1908.) 15 pp. Oct. 23	1,000
Doc. 1255. Government versus Administration in Relation to the Agricultural Colleges and Experiment Stations. (From Expt. Sta. Record, Vol. XXII, No. 2.) 11 pp. Mar. 3	1,000
Experiment Station Work (compiled from the publications of the State Experiment Stations):	
Vol. III, No. 12. 32 pp. Aug. 12	3,500
Vol. III, No. 13. 32 pp. Nov. 3	3,500
Vol. III, No. 14. 32 pp. Dec. 23	3,500
Vol. III, No. 15. 32 pp. Feb. 16	3,500
Vol. III, No. 16. 31 pp. Apr. 13	3,500
Lists of Station Publications Received during—	
June, 1909. 6 pp. July 13	4,500
July, 1909. 5 pp. Aug. 18	4,500
August, 1909. 5 pp. Sept. 16	4,500
September, 1909. 5 pp. Oct. 15	4,500
October, 1909. 6 pp. Nov. 20	4,500
November, 1909. 5 pp. Dec. 21	4,500
December, 1909. 5 pp. Jan. 26	4,500
January, 1910. 5 pp. Mar. 18	4,500
February, 1910. 6 pp. Mar. 23	4,500
March, 1910. 8 pp. Apr. 16	4,500
April, 1910. 9 pp. May 19	4,500
May, 1910. 6 pp. June 28	4,500

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Publications issued during the year ended June 30, 1910, etc.—Continued.

OFFICE OF EXPERIMENT STATIONS—Continued.

NEW PUBLICATIONS—Continued.

	Copies.
Miscellaneous Circulars:	
Doc. 1180. Organization, Work, and Publications of Drainage Investigations. 5 pp. Aug. 12	2,000
Doc. 1210. Forestry in Nature Study. Gifford Pinchot. 10 pp. Sept. 30, 3,000; Nov. 10, 1,200	4,200
Address List Agricultural Experiment Stations in the United States. 1 p. Aug. 6	1,000
Address List Agricultural and Mechanical Colleges in the United States. 1 p. Aug. 9	1,000
Farmers' Bulletins:	
No. 363. The Use of Milk as Food. R. D. Milner. 46 pp. July 15, 15,000; Sept. 25, 10,000; Dec. 4, 10,000; Mar. 8, 20,000	55,000
No. 366. Experiment Station Work—LII. 32 pp. July 22, 30,000; June 14, 10,000	40,000
No. 371. Drainage of Irrigated Lands. Charles F. Brown. 52 pp. Oct. 4, 20,000; Feb. 14, 15,000	35,000
No. 373. Irrigation of Alfalfa. Samuel Fortier. 32 pp. Nov. 1, 20,000; Mar. 5, 15,000; Apr. 21, 15,000	50,000
No. 374. Experiment Station Work—LIII. 32 pp. Oct. 4, 20,000; Feb. 17, 20,000	40,000
No. 375. Care of Food in the Home. Mary Hinman Abel. 48 pp. Nov. 20, 20,000; Dec. 16, 40,000; Feb. 15, 20,000; Apr. 7, 20,000; Apr. 12, 30,000; Apr. 16, 40,000; June 1, 20,000	190,000
No. 381. Experiment Station Work—LIV. 32 pp. Nov. 29, 20,000; Mar. 7, 10,000	30,000
No. 384. Experiment Station Work—LV. 32 pp. Feb. 7, 20,000; Apr. 5, 10,000	30,000
No. 385. Boys' and Girls' Agricultural Clubs. F. W. Howe. 32 pp. Feb. 4, 20,000; Feb. 23, 50,000; Apr. 7, 40,000	110,000
No. 388. Experiment Station Work—LVI. 32 pp. Mar. 24	20,000
No. 389. Bread and Bread Making. Helen W. Atwater. 47 pp. Apr. 15, 30,000; May 7, 50,000; June 6, 50,000	130,000
No. 391. Economical Use of Meat in the Home. C. F. Langworthy and Caroline L. Hunt. 45 pp. Mar. 23, 50,000; April 4, 100,000; Apr. 14, 200,000; Apr. 25, 100,000; Apr. 27, 100,000; May 2, 100,000; May 5, 100,000; May 19, 100,000; June 2, 50,000	900,000
No. 392. Irrigation of Sugar Beets. F. W. Roeding. 52 pp. Apr. 15	20,000
No. 394. The Use of Windmills in Irrigation in the Semi-arid West. P. E. Fuller. 44 pp. May 5	15,000
No. 399. Irrigation of Grain. Walter W. McLaughlin. 23 pp. May 18	15,000
No. 404. Irrigation of Orchards. Samuel Fortier. 36 pp. June 30	20,000
No. 405. Experiment Station Work—LVII. 32 pp. June 21	15,000

EARLIER PUBLICATIONS REPRINTED.

Bulletins:	
No. 144. Irrigation in Northern Italy. Part I. Elwood Mead. 100 pp. 20 cts. Sept. 20	500
No. 177. Evaporation Losses in Irrigation and Water Requirements of Crops. Samuel Fortier. 64 pp. 10 cts. May 21	1,000
No. 181. Mechanical Tests of Pumping Plants in California. J. N. Conte and C. E. Tait. 72 pp. 15 cts. Oct. 13	500
No. 203. Distribution of Water in the Soil in Furrow Irrigation. R. H. Loughridge. 63 pp. 10 cents. Oct. 28	1,000
No. 206. Organization Lists of the Agricultural Colleges and Experiment Stations in the United States. 114 pp. 10 cts. July 29	500
No. 2. Alaska Experiment Station. Vegetable Growing in Alaska. C. C. Georgeson. 46 pp. 5 cts. May 24	1,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

OFFICE OF EXPERIMENT STATIONS—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

	Copies.
Circulars:	
No. 6. Fertilizadores Abonos. D. W. May. 18 pp. May 5	1,000
No. 46 (Revised). The Functions and Uses of Food. 11 pp. Apr. 14	500
No. 51 (Revised). List of State Directors of Farmers' Institutes and Institute Lecturers of the United States. 14 pp. Dec. 17	3,000
No. 60. The Teaching of Agriculture in the Rural Common Schools. 20 pp. Jan. 13	3,000
No. 70 (Revised). Publications of the Office of Experiment Stations from Its Organization to June 30, 1909. 20 pp. Sept. 20	1,500
No. 76. Swamps and Overflowed Lands in the United States. Ownership and Reclamation. J. O. Wright. 23 pp. Aug. 4	500
Experiment Station Record:	
Vol. XIX, No. 2, October, 1907. 110 pp. Feb. 28	300
Vol. XIX, No. 10, June, 1908. 109 pp. Feb. 28	300
Vol. XIX, No. 11, July, 1908. 109 pp. Feb. 28	300
Vol. XX, No. 1, September, 1908. 110 pp. July 2	500
Vol. XX, No. 2, October, 1908. 110 pp. July 2	500
Farmers' Institute Lecture:	
No. 10 (Revised). Syllabus of Illustrated Lecture on the Production and Marketing of Eggs and Fowls. 20 pp. Apr. 5	1,500
Yearbook Extracts and Separates:	
No. 233. Some Problems of the Rural Common Schools. A. C. True. (From Ybk. 1901.) 24 pp. Aug. 9, 500; Nov. 26, 1,000	1,500
No. 285. Progress in Secondary Education in Agriculture. A. C. True. (From Ybk. 1902.) 24 pp. Aug. 9	500
No. 324. Wheat Flour and Bread. Harry Snyder and Charles D. Woods. (From Ybk. 1903.) 19 pp. Feb. 19	500
No. 382. The Uses of Illustrated Material in Teaching Agriculture in Rural Schools. Dick J. Crosby. (From Ybk. 1905.) 83 pp. Feb. 1	1,500
Doc. 1131. Statistics of Land-Grant Colleges and Agricultural Experiment Stations. Compiled by M. T. Spethman. (From An. Rpt. 1907, O. E. S.) 40 pp. July 20	500
No. 2. (From An. Rpt. Irrigation and Drainage Investigations, 1904.) Elwood Mead. 183 pp. Aug. 9	500
Farmers' Bulletins:	
No. 22 (Revised). The Feeding of Farm Animals. E. W. Allen. 39 pp. Sept. 2, 20,000; Oct. 9, 15,000; Jan. 19, 15,000; Feb. 19, 15,000; Apr. 6, 15,000; May 26, 15,000	95,000
No. 32 (Revised). Silos and Silage. Charles S. Plumb. 32 pp. Feb. 4, 10,000; May 27, 10,000	20,000
No. 34. Meats: Composition and Cooking. Charles D. Woods. 31 pp. Aug. 24, 10,000; Nov. 22, 10,000; Feb. 24, 10,000; May 13, 10,000	40,000
No. 35. Potato Culture. J. F. Duggar. 23 pp. Oct. 4, 10,000; Dec. 3, 15,000; Feb. 3, 15,000; May 6, 15,000	55,000
No. 36. Cotton Seed and Its Products. 16 pp. Aug. 24, 10,000; Jan. 22, 10,000	20,000
No. 44. Commercial Fertilizers: Composition and Use. Edward B. Voorhees. 39 pp. Oct. 15, 5,000; Feb. 1, 10,000; Apr. 7, 10,000	25,000
No. 48. The Manuring of Cotton. H. C. White. 16 pp. Feb. 14, 10,000; June 6, 20,000	30,000
No. 49. Sheep Feeding. John A. Craig. 30 pp. Aug. 4, 10,000; Oct. 26, 10,000; Apr. 19, 10,000; Apr. 21, 10,000	40,000
No. 56. Experiment Station Work—I. 32 pp. Nov. 20, 5,000; Mar. 4, 5,000	10,000
No. 66. Experiment Station Work—II. 32 pp. Jan. 29, 5,000; June 10, 10,000	15,000
No. 69. Experiment Station Work—III. 32 pp. Feb. 1	5,000
No. 73. Experiment Station Work—IV. 31 pp. Jan. 29	5,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

OFFICE OF EXPERIMENT STATIONS—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

Farmers' Bulletins—Continued.	Copies.
No. 77. The Liming of Soils. H. J. Wheeler. 23 pp. Oct. 15, 5,000; Dec. 16, 5,000; Jan. 29, 10,000; Apr. 28, 10.000; May 24, 10,000	40,000
No. 78. Experiment Station Work—V. 31 pp. Apr. 29	10,000
No. 79. Experiment Station Work—VI. 30 pp. Oct. 9, 5,000; Apr. 15, 5,000	10,000
No. 81. Corn Culture in the South. S. M. Tracy. 24 pp. Aug. 12, 10,000; Dec. 4, 10,000	20,000
No. 84. Experiment Station Work—VII. 31 pp. May 6, 10,000; Oct. 22, 10,000	20,000
No. 85. Fish as Food. C. F. Langworthy. 32 pp. Aug. 12, 5,000; Nov. 23, 5,000; Mar. 5. 10,000; June 4, 5,000	25,000
No. 87. Experiment Station Work—VIII. 32 pp. Feb. 12, 5,000; May 11, 5,000	10,000
No. 92. Experiment Station Work—IX. 32 pp. Aug. 10, 5,000; Nov. 2, 5,000	10,000
No. 93. Sugar as Food. Mary Hinman Abel. 31 pp. Dec. 17, 10,000; Apr. 19, 10,000	20,000
No. 97. Experiment Station Work—X. 31 pp. Apr. 11	5,000
No. 103. Experiment Station Work—XI. 32 pp. Mar. 26	5,000
No. 105. Experiment Station Work—XII. 31 pp. Oct. 4, 5,000; Feb. 25, 5,000	10,000
No. 112. Bread and the Principles of Bread Making. Helen W. Atwater. 40 pp. July 7, 5,000; July 29, 10,000; Oct. 23, 10,000	25,000
No. 114. Experiment Station Work—XIV. 30 pp. Dec. 7, 5,000; Apr. 12, 10,000	15,000
No. 119. Experiment Station Work—XV. 32 pp. Feb. 25	5,000
No. 121. Beans, Peas, and other Legumes as Food. Mary Hinman Abel. 40 pp. Oct. 15, 5,000; Feb. 21, 10,000; May 16, 10,000	25,000
No. 122. Experiment Station Work—XVI. 32 pp. Feb. 16	5,000
No. 124. Experiment Station Work—XVII. 32 pp. Feb. 12	5,000
No. 128. Eggs and their Uses as Food. C. F. Langworthy. 40 pp. Oct. 15, 10,000; Feb. 12, 10,000; Apr. 22, 10,000	30,000
No. 133. Experiment Station Work—XVIII. 32 pp. Oct. 9, 5,000; Mar. 4, 5,000; Mar. 31, 10,000	20,000
No. 138. Irrigation in Field and Garden. E. J. Wickson. 40 pp. Mar. 8, 10,000; Mar. 11, 10,000	20,000
No. 142. Principles of Nutrition and Nutritive Value of Food. W. O. Atwater. 48 pp. Nov. 16, 10,000; Feb. 23, 10,000; May 23, 10,000	30,000
No. 144. Experiment Station Work—XIX. 32 pp. Feb. 12	5,000
No. 158. How to Build Small Irrigation Ditches. C. T. Johnson and J. D. Stannard. 30 pp. Feb. 18, 10,000; May 13, 10,000	20,000
No. 162. Experiment Station Work—XXI. 32 pp. Mar. 16	5,000
No. 169. Experiment Station Work—XXII. 32 pp. Feb. 10, 5,000; May 27, 5,000	10,000
No. 170. The Principles of Horse Feeding. C. F. Langworthy. 46 pp. July 29, 10,000; Oct. 30, 15,000; Feb. 21, 10,000; May 16, 10,000	45,000
No. 182. Poultry as Food. Helen W. Atwater. 37 pp. Oct. 5, 10,000; Feb. 10, 10,000; Apr. 15, 10,000	30,000
No. 186. Experiment Station Work—XXIII. 32 pp. May 26	10,000
No. 187. Drainage of Farm Lands. C. G. Elliott. 40 pp. July 1, 10,000; Nov. 1, 10,000; Feb. 23, 10,000; May 13, 10,000	40,000
No. 190. Experiment Station Work—XXIV. 32 pp. Dec. 31, 5,000; Apr. 14, 5,000	10,000
No. 192. Barnyard Manure. W. H. Beal. 32 pp. Aug. 10, 20,000; Mar. 15, 10,000; Apr. 27, 10,000	40,000
No. 193. Experiment Station Work—XXV. 32 pp. May 27	10,000
No. 202. Experiment Station Work—XXVI. 32 pp. Feb. 15, 5,000; May 11, 10,000	15,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

OFFICE OF EXPERIMENT STATIONS—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

Farmers' Bulletins—Continued.	Copies.
No. 203. Canned Fruits, Preserves, and Jellies: Household Methods of Preparation. Maria Parloa. 31 pp. July 13, 20,000; Aug. 6, 10,000; Dec. 17, 10,000; Mar. 10, 20,000; Mar. 11, 20,000; Mar. 31, 20,000; Apr. 14, 40,000; May 13, 30,000	170,000
No. 210. Experiment Station Work—XXVII. 32 pp. Mar. 3	5,000
No. 217. Essential Steps in Securing an Early Crop of Cotton. R. J. Redding. 16 pp. Aug. 24, 10,000; Feb. 9, 15,000	25,000
No. 222. Experiment Station Work—XXVIII. 32 pp. Oct. 6	10,000
No. 225. Experiment Station Work—XXIX. 32 pp. Nov. 3	10,000
No. 227. Experiment Station Work—XXX. 32 pp. May 16	10,000
No. 233. Experiment Station Work—XXXI. 32 pp. June 13	5,000
No. 234. Guinea Fowl and Its Use as Food. C. L. Langworthy. 24 pp. Jan. 3, 10,000; Apr. 13, 10,000	20,000
No. 237. Experiment Station Work—XXXII. 32 pp. Feb. 2, 5,000; Apr. 30, 10,000	15,000
No. 244. Experiment Station Work—XXXIII. 32 pp. Nov. 30, 5,000; June 6, 10,000	15,000
No. 249. Cereal Breakfast Foods. Charles D. Woods. 38 pp. Dec. 9, 15,000; May 11, 5,000	20,000
No. 251. Experiment Station Work—XXXIV. 32 pp. Feb. 15	5,000
No. 256. Preparation of Vegetables for the Table. Maria Parloa. 48 pp. Jan. 14, 15,000; Feb. 25, 15,000; Apr. 8, 40,000; Apr. 28, 40,000; May 16, 20,000; May 20, 30,000; June 6, 50,000; June 10, 30,000	240,000
No. 259. Experiment Station Work—XXXV. 32 pp. Mar. 16, 5,000; May 11, 10,000	15,000
No. 262. Experiment Station Work—XXXVI. 32 pp. Feb. 26	5,000
No. 263. Practical Information for Beginners in Irrigation. Samuel Fortier. 40 pp. Nov. 9, 10,000; Feb. 26, 5,000; June 6, 10,000	25,000
No. 270. Modern Conveniences for the Farm Home. Elmina T. Wilson. 48 pp. Nov. 8, 10,000; Feb. 23, 15,000; May 8, 15,000	40,000
No. 273. Experiment Station Work—XXXVIII. 32 pp. Mar. 9	5,000
No. 276. Experiment Station Work—XXXIX. 32 pp. June 17	10,000
No. 277. The Use of Alcohol and Gasoline in Farm Engines. Edward Lucke. 40 pp. Dec. 11, 10,000; June 11, 10,000	20,000
No. 281. Experiment Station Work—XL. 32 pp. June 13, 10,000; Mar. 2, 5,000	15,000
No. 293. Use of Fruit as Food. C. F. Langworthy. 40 pp. Aug. 2, 10,000; Feb. 21, 15,000; May 11, 15,000	40,000
No. 295. Potatoes and Other Root Crops as Food. C. F. Langworthy. 47 pp. Nov. 3, 10,000; Feb. 14, 10.000; June 6, 30,000	50,000
No. 296. Experiment Station Work—XLI. 32 pp. Mar. 4, 5,000; June 21, 5,000	10,000
No. 298. Food Value of Corn and Corn Products. Charles D. Woods. 40 pp. Dec. 14, 10,000; Apr. 1, 15,000	25,000
No. 303. Corn-Harvesting Machinery. C. J. Zintheo. 32 pp. Mar. 26	10,000
No. 305. Experiment Station Work—XLII. 32 pp. June 13	20,000
No. 309. Experiment Station Work—XLIII. 32 pp. Sept. 25, 5,000; Apr. 29, 10,000	15,000
No. 316. Experiment Station Work—XLIV. 32 pp. Apr. 16	10,000
No. 317. Experiment Station Work—XLV. 32 pp. Nov. 8	10,000
No. 320. Experiment Station Work—XLVI. 32 pp. Jan. 24	10,000
No. 329. Experiment Station Work—XLVII. 32 pp. Nov. 5	10,000
No. 332. Nuts and Their Uses as Food. M. E. Jaffa. 30 pp. Nov. 6, 10,000; Mar. 10, 10,000; June 6, 15.000	35,000
No. 334. Experiment Station Work—XLVIII. 32 pp. Mar. 18	5,000
No. 353. Experiment Station Work—L. 32 pp. Feb. 23	10,000
No. 360. Experiment Station Work—LI. 32 pp. Aug. 24, 10,000; Jan. 15, 5,000; May 23, 10,000	25,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

FOREST SERVICE.

NEW PUBLICATIONS.

	Copies.
Bulletins:	
No. 76. How to Grow and Plant Conifers in the Northeastern States. C. R. Pettis. 36 pp. 10 cts. Nov. 15, 1,500; May 18, 1,000	2,500
No. 78. Wood Preservation in the United States. W. F. Sherfesee. 31 pp. 10 cts. Nov. 12, 4,000; May 26, 500	4,500
No. 79. The Life History of Lodgepole Burn Forests. F. E. Clements. 56 pp. 15 cts. June 20	10,000
Circulars:	
No. 160. Coyote-Proof Pasture Experiment 1908. James T. Jardine in Cooperation with B. P. I. 40 pp. Oct. 1, 7,000; Feb. 23, 3,000	10,000
No. 163. Paper Birch in the Northwest. S. T. Dana. 37 pp. July 7	13,000
No. 164. Properties and Uses of Southern Pines. H. S. Betts. 30 pp. Aug. 31	30,000
No. 166. The Timber Supply of the United States. R. S. Kellogg. 24 pp. July 10	10,000
No. 167. The Status of Forestry in the United States. Treadwell Cleveland, jr. 39 pp. Sept. 17	20,000
No. 168. Commercial Importance of the White Mountain Forest. Philip W. Ayres. 32 pp. Nov. 4	20,000
No. 169. Natural Revegetation of Depleted Mountain Grazing Lands. Arthur W. Sampson. 28 pp. Sept. 30, 5,000; Dec. 16, 6,000; June 15, 700	11,700
No. 171. Forests of the United States: Their use. Overton W. Price, R. S. Kellogg, and W. T. Cox. 35 pp. Dec. 11, 25,000; June 11, 5,000	30,000
No. 172. Methods of Increasing Forest Productivity. E. E. Carter. 16 pp. Dec. 20, 25,000; May 16, 1,000	26,000
No. 174. Production of Western Yellow Pine in the Southwest. G. A. Pearson. 16 pp. Jan. 5, 10,000; May 16, 2,000	12,000
No. 176. Surface Conditions and Stream Flow. W. L. Hall and Hu Maxwell. 16 pp. Jan. 11	25,000
Annual Report:	
Annual Report of the Forester for 1909. Gifford Pinchot. (From An. Rpt. of Dept., 1909.) 45 pp. Jan. 5	2,500
Silvical Leaflets:	
No. 43. Red or Norway Pine (*Pinus resinosa* Ait.). 4 pp. July 16	8,000
No. 44. Jack Pine (*Pinus divaricata* (Ait.) Du Mont de Cours). 4 pp. July 16	8,000
No. 46. Limber Pine (*Pinus flexilis* James). 4 pp. July 19	8,000
No. 47. Pinon Pine (*Pinus edulis* Engelm.). 4 pp. July 24	8,000
No. 50. Big Shellbark: King-Nut Hickory (*Hicoria laciniosa* (Michf.) Sargent). 3 pp. July 24	8,000
Field Programs:	
Index to Service Notes and Orders in the Field Programs, July, 1908–June, 1909. 10 pp. Dec. 9	3,800
For July, 1909. 32 pp. July 2	3,500
For August, 1909. 32 pp. July 30	3,600
For September, 1909. 32 pp. Sept. 1	3,700
For October, 1909. 28 pp. Oct. 1	3,700
For November, 1909. 32 pp. Nov. 4	3,700
For December, 1909. 32 pp. Dec. 2	3,700
For January, 1910. 33 pp. Jan. 1	3,700
For February, 1910. 32 pp. Feb. 1	3,700
For March, 1910. 38 pp. Mar. 1	3,700
For April, 1910. 35 pp. Apr. 2	3,700
For May, 1910. 28 pp. May 2	3,700
For June, 1910. 30 pp. June 1	3,700
Classified Lists of Publications Available for Distribution:	
List for September, 1909. 4 pp. Sept. 9	5,000
List for October, 1909. 4 pp. Oct. 5	5,000
List for November, 1909. 4 pp. Nov. 15	10,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

FOREST SERVICE—Continued.

NEW PUBLICATIONS—Continued.

	Copies.
National Forest Areas:	
National Forests of Arkansas. 4 pp. Oct. 18	2,500
Miscellaneous Circulars:	
Forest Trees of the Pacific Slope. George B. Sudworth. 441 pp. 60 cts. Aug. 10	1,000
The Use Book: Regulations and Instructions for the Use of the National Forests, and Manual of Procedure for Forest Officers. Issued Jan. 1, 1910. Grazing, 1910. 84 pp. Aug. 2, 1,000; Jan. 6, 25,000	26,000
Farmers' Bulletin:	
No. 387. The Preservative Treatment of Farm Timbers. C. P. Willis. 19 pp. Mar. 10	25,000

EARLIER PUBLICATIONS REPRINTED.

Bulletins:	
No. 41. Seasoning of Timber. Hermann von Schrenk and Reynolds Hill. 48 pp. 25 cts. Sept. 27	500
No. 61. Terms used in Forestry and Logging. Prepared in Cooperation with the Society of American Foresters. 53 pp. 5 cts. July 23	500
No. 64. Loblolly Pine in Eastern Texas, with Special Reference to the Production of Cross-ties. Paul Zon. 53 pp. 5 cts. July 27	500
No. 70. Effect of Moisture Upon the Strength and Stiffness of Wood. Harry Donald Tiermann. 14 pp. 10 cts. May 28	500
No. 72. Wolves in Relation to Stock, Game, and the National Forest Reserves. Vernon Bailey. 31 pp. 5 cts. July 25	500
Circulars:	
No. 15. Summary of Mechanical Tests of Thirty-two Species of American Woods. 15 pp. Apr. 22	500
No. 25. Forestry and the Lumber Supply. Forestry and Foresters, by Theodore Roosevelt. The Exhaustion of the Lumber Supply, by R. L. McCormick. The Lumberman and the Forester, by Gifford Pinchot. 14 pp. Nov. 13	1,000
No. 39. Experiments on the Strength of Treated Timber. W. Kendrick Hatt. 31 pp. Sept. 17, 1,000; Apr. 22, 500	1,500
No. 45. Forest Planting in Eastern Nebraska. Frank G. Miller. 32 pp. July 21	1,000
No. 48. Kiln-Drying Hardwood Lumber. Frederick Dunlap. 19 pp. Apr. 21	500
No. 55. How to Pack and Ship Young Forest Trees. 2 pp. Apr. 22	500
No. 56 (Revised). Bur Oak (*Quercus macrocarpa*). 3 pp. Aug. 9, 1,000; Apr. 12, 2,000	3,000
No. 57. Jack Pine (*Pinus divaricata*). 2 pp. July 7	1,500
No. 59 (Revised). Eucalypts. 13 pp. May 16	500
No. 60. Red Pine (*Pinus resinosa*). 2 pp. July 7	1,500
No. 63. Basswood (*Tilia americana*). 3 pp. Apr. 29	500
No. 64. Black Locust (*Robinia pseudacacia*). 4 pp. Oct. 18, 1,000; Apr. 29, 500	1,500
No. 65. Norway Spruce (*Picea excelsa*). 4 pp. July 7	800
No. 66. White Elm (*Ulmus americana*). 4 pp. Apr. 30	500
No. 67. White Pine (*Pinus strobus*). 6 pp. Apr. 29	500
No. 68. Scotch Pine (*Pinus sylvestris*). 4 pp. Apr. 29	500
No. 70. European Larch (*Larix europæa*). 3 pp. Aug. 11, 1,000; May 11, 500	1,500
No. 73. Red Cedar (*Juniperus virginiana*). 4 pp. July 7	1,000
No. 74. Honey Locust (*Gleditsia triacanthos*). 3 pp. May 5	500
No. 75. Hackberry (*Celtis occidentalis*). 3 pp. May 5	500
No. 76. Silver Maple (*Acer saccharinum*). 3 pp. Aug. 4, 500; May 5, 500; May 18, 1,000	2,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

FOREST SERVICE—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

Circulars—Continued. Copies.

No. 80. The Fractional Distillation of Coal-Tar Creosote. Arthur L. Dean and Ernest Bateman. 31 pp. Aug. 5 500

No. 81 (Revised). Forest Planting in Illinois. R. S. Kellogg. 32 pp. Jan. 13 5,500

No. 82. Hardy Catalpa (*Catalpa speciosa*). 8 pp. Feb. 24 500

No. 84. White Ash (*Fraxinus americana*). 4 pp. July 1 700

No. 86 (Revised). Boxelder (*Acer negundo*). 3 pp. Aug. 10 1,000

No. 87. White Willow (*Salix alba*). 4 pp. May 20 500

No. 88 (Revised). Black Walnut (*Juglans nigra*). 5 pp. Aug. 17 1,000

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No. 91. Coffeetree (*Gymnocladus dioicus*). 4 pp. July 27 1,000

No. 93. Yellow, or Tulip Poplar (*Liriodendron tulipfera*). 4 pp. Aug. 4 1,000

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No. 96. Arbor Day. 4 pp. May 5 500

No. 101. The Open Method for the Treatment of Timbers. Carl G. Crawford. 15 pp. May 18 500

No. 202. The Production of Red Cedar for Pencil Wood. L. L. White. 19 pp. July 10 500

No. 103. Seasoning of Telephone and Telegraph Poles. Henry Grinwell. 16 pp. July 15 500

No. 104. Brush and Tank Pole Treatments. Carl G. Crawford. 24 pp. July 1 500

No. 112. The Analysis and Grading of Creosotes. Arthur L. Dean and Ernest Bateman. 44 pp. July 20 500

No. 115. Second Progress Report of the Strength of Structural Timber. W. Kendrick Hatt. 39 pp. Aug. 19 2,000

No. 116. The Waning Hardwood Supply and the Appalachian Forests. William L. Hall. 16 pp. July 15, 1,000; May 16, 500 1,500

No. 117. The Preservative Treatment of Fence Posts. Howard F. Weiss. 15 pp. Nov. 20 500

No. 132. The Seasoning and Preservative Treatment of Hemlock and Tamarack Crossties. W. F. Sherfesee. 31 pp. July 7, 500; May 16, 500 1,000

No. 141. Wood Paving in the United States. C. L. Hill. 24 pp. May 12 500

No. 142. Tests of Vehicle and Implement Woods. H. B. Holroyd and H. S. Betts. 29 pp. July 7, 500; Dec. 6, 500 1,000

No. 145. Forest Planting on the Northern Prairies. James M. Fetherolf. 28 pp. Nov. 5 1,000

No. 146. Experiments with Railway Cross-ties. H. B. Eastman. 22 pp. July 9, 500; May 20, 500 1,000

No. 147. Progress in Chestnut Pole Preservation. Howard F. Weiss. 14 pp. July 1 500

No. 148. Practical Results in Basket Willow Culture. C. D. Mell. 7 pp. July 1, 500; Dec. 3, 1,000 1,500

No. 150. Douglas Fir: A Study of the Pacific Coast and Rocky Mountain Forms. E. H. Frothingham. 38 pp. Nov. 22 1,000

No. 151. The Preservative Treatment of Loblolly Pine Cross-ties. W. F. Sherfesee. 29 pp. Dec. 20, 25,000; May 16, 500 25,500

No. 154. Native and Planted Timber of Iowa. Hugh P. Baker. 24 pp. June 27 500

No. 156. Preliminary Report of Grazing Experiments in a Coyote-proof Pasture. James T. Jardine, with an Introduction by F. V. Coville. 32 pp. July 7, 200; June 3, 500 700

No. 158. The Revegetation of Overgrazed Range Areas. Arthur W. Sampson, with an Introduction by F. V. Coville. 21 pp. Nov. 18 500

No. 159. The Future Use of Land in the United States. Raphael Zon. 15 pp. Nov. 22, 1,000; Aug. 2, 1,000 2,000

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Yearbook Extracts:	
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Silvical Leaflets:	
No. 24. Bristle-cone Fir (*Abies venusta*). 2 pp. Oct. 12, 500; Oct. 27, 500; May 6, 1,600	2,600
No. 27. Torrey Pine (*Pinus Torreyana*). 2 pp. Oct. 12	500
Miscellaneous Circulars:	
The Use Book: Regulations and Instructions for the Use of the National Forests. 1908. Abridged. Popular Edition. 109 pp. Sept. 14, 5,000; Feb. 14, 5,000	10,000
Information Regarding Employment on the National Forests (3d revision). 4 pp. Sept. 14, 3,000; Jan. 17, 1,000; May 27, 1,000	5,000
Suggestions for the Collection of Range Plant Specimens on National Forests. 3 pp. May 10	1,000
The Green Book. 47 pp. Dec. 11	200
Regulations Governing Applications Under the Act of June 11, 1906. 4 pp. Oct. 4	5,000
Instructions for Making Forest Maps and Surveys. Revised. 51 pp. Feb. 24	5,000
Farmers' Bulletins:	
No. 134. Tree Planting on Rural School Grounds. Wm. L. Hall. 32 pp. Jan. 5, 15,000; Feb. 18, 15,000; June 25, 5,000	35,000
No. 173. A Primer of Forestry, Part I. Gifford Pinchot. 47 pp. Oct. 20, 15,000; Dec. 17, 15,000; Feb. 24, 15,000; June 1, 15,000	60,000
No. 228. Forest Planting and Farm Management. George T. Clothier. 24 pp. July 28, 15,000; Mar. 10, 15,000	30,000
No. 252. Maple Sugar and Sirup. William F. Hubbard. 38 pp. Dec. 14, 5,000; April 11, 5,000	10,000
No. 341. The Basket Willow. William F. Hubbard. 47 pp. Mar. 12	5,000
No. 358. A Primer of Forestry, Part II. Gifford Pinchot. 48 pp. Sept. 17, 15,000; Dec. 29, 15,000; Feb. 28, 15,000; Mar. 20, 25,000	70,000

LIBRARY.

NEW PUBLICATIONS.

Bulletins:	
No. 71. Accessions to the Department Library, January–March, 1909. 81 pp. 10 cts. July 6	1,000
No. 72. Accessions to the Department Library, April–June, 1909. 90 pp. 10 cts. Sept. 30	1,000
No. 73. Accessions to the Department Library, July–September, 1909. 63 pp. 10 cts. Nov. 20	1,000
No. 74. Accessions to the Department Library, October–December, 1909. 68 pp. 10 cts. Mar. 14	1,000
No. 75. List of Periodicals Currently Received in Library of the United States Department of Agriculture, Arranged by Title and Subject. 72 pp. 10 cts. Dec. 23	1,000
Monthly Bulletin (Price 50 cts. per annum. No single copies sold):	
For January, 1910. Vol. I, No. 1. 25 pp. Mar. 15	1,000
For February, 1910. Vol. I, No. 2. 25 pp. Apr. 11	1,000
For March, 1910. Vol. I, No. 3. 28 pp. May 3	1,000
For April, 1910. Vol. I, No. 4. 31 pp. June 6	1,000
Annual Report:	
Report of the Librarian for 1909. Claribel R. Barnett. (From An. Rpts. of Dept., 1909.) 16 pp. Nov. 15	350

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF PLANT INDUSTRY.

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Bulletins: Copies.

No. 141. Miscellaneous Papers. Part V. The Present Status of the Chestnut Bark Disease. Haven Metcalf and Franklin Collins. 10 pp. 5 cts. Aug. 31 — 4,500

No. 141. Miscellaneous Papers. Parts I–V. 56 pp. 10 cts. Sept. 24 — 2,500

No. 149. Diseases of Deciduous Fruit Trees. Hermann von Schrenk and Perley Spaulding. 85 pp. 15 cts. July 1 — 5,500

No. 152. The Loose Smuts of Barley and Wheat. E. M. Freeman and Edward C. Johnson. 48 pp. 15 cts. July 13 — 2,000

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No. 155. The Control of Black-rot of the Grape. C. L. Shear, George F. Miles, and Lon A. Hawkins. 42 pp. 15 cts. Aug. 31 — 3,500

No. 156. A Study of Diversity in Egyptian Cotton. O. F. Cook, Argyle McLachlan, and Rowland M. Meade. 60 pp. 15 cts. July 24 — 2,000

No. 157. The Truckee-Carson Experiment Farm. Carl S. Scofield and Shober J. Rogers. 38 pp. 10 cts. Aug. 11 — 2,000

No. 158. The Root-rot of Tobacco Caused by *Thielavia basicola*. W. W. Gilbert. 55 pp. 15 cts. Oct. 7 — 2,000

No. 159. Local Adjustment of Cotton Varieties. O. F. Cook. 75 pp. 10 cts. Sept. 28 — 2,000

No. 160. Italian Lemons and Their By-products. I. The Italian Lemon Industry. G. Harold Powell. II. The By-Products of the Lemon in Italy. E. M. Chase. 57 pp. 15 cts. Oct. 6 — 5,500

No. 161. A New Type of Indian Corn from China. G. N. Collins. 30 pp. 10 cts. Dec. 9 — 2,000

No. 162. Seeds and Plants Imported, January to March 31, 1909. Inventory No. 18: Nos. 24430 to 25191. 73 pp. 10 cts. Dec. 23 — 2,000

No. 163. Varieties of American Upland Cotton. Frederick J. Tyler. 127 pp. 25 cts. Feb. 25 — 1,000

No. 164. Promising Root Crops for the South. I. Yautias, Taros, and Dasheens. O. W. Barrett. II. Agricultural History and Utility of the Cultivated Aroids. O. F. Cook. 43 pp. 10 cts. Feb. 5 — 2,000

No. 165. Application of Some of the Principles of Heredity to Plant Breeding. W. J. Spillman. 74 pp. 10 cts. Jan. 3 — 2,000

No. 166. The Mistletoe Pest of the Southwest. William J. Bray. 39 pp. 10 cts. Feb. 2 — 4,500

No. 167. New Methods of Plant Breeding. George W. Oliver. 39 pp. 20 cts. Feb. 9 — 2,000

No. 168. Seeds and Plants Imported, April 1 to June 30, 1909. Inventory No. 19: Nos. 25192 to 25717. 45 pp. 5 cts. Dec. 29 — 2,000

No. 169. Variegated Alfalfa. J. M. Westgate. 63 pp. 10 cts. Feb. 3 — 2,500

No. 170. Traction Plowing. L. W. Ellis. 45 pp. 10 cts. Mar. 12 — 6,000

No. 171. Some Fungous Diseases of Economic Importance. Flora W. Patterson, Vera K. Charles, and Frank J. Veihmeyer. 41 pp. 25 cts. June 25 — 2,000

No. 173. Seasonal Nitrification as Influenced by Crops and Tillage. C. A. Jensen. 31 pp. 10 cts. Apr. 19 — 2,000

No. 174. The Control of the Peach Brown-rot and Scab. W. M. Scott and T. Willard Ayres. 31 pp. 10 cts. Mar. 7 — 6,000

No. 175. The History and Distribution of Sorghum. Carleton R. Ball. 63 pp. 10 cts. Apr. 14 — 2,000

No. 176. Seeds and Plants Imported, July 1 to September 30, 1909. Inventory No. 20: Nos. 25718 to 26047. 34 pp. 5 cts. Apr. 25 — 2,000

No. 177. A Protected Stock Range in Arizona. David Griffiths. 28 pp. 10 cts. Apr. 20 — 3,000

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No. 179. The Florida Velvet Bean and Related Plants. C. V. Piper and S. M. Tracy. 26 pp. 10 cts. May 20	2,000
Circulars:	
No. 30. Improvement of the Oat Crop. C. W. Warburton. 10 pp. July 1, 2,500; Oct. 30, 1,000; Jan. 21, 2,000	5,500
No. 32. Moisture Content and Shrinkage in Grain. J. W. T. Duvel. 13 pp. July 6	3,000
No. 34. The Work of the San Antonio Experiment Farm in 1908. Frank B. Headley and Stephen H. Hastings. 17 pp. July 22	2,500
No. 35. The Present Status of the White-pine Blights. Perley Spaulding. 12 pp. Aug. 25	9,000
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No. 44. The Minor Articles of Farm Equipment. L. W. Ellis. 15 pp. June 17, 1,000; Jan. 19, 5,600	6,600
No. 45. The Utilization of Pea-cannery Refuse for Forage. M. A. Crosby. 3 pp. Feb. 4, 4,000; Mar. 28, 1,500	5,500
No. 46. The limitation of Satsuma Orange to Trifoliate-orange Stock. Walter T. Swingle. 10 pp. Jan. 3	5,000
No. 47. Prickly Comfrey as a Forage Crop. H. N. Vinall. 9 pp. Jan. 24	3,500
No. 48. The Present Status of the Tobacco Industry. Wightman W. Garner. 13 pp. Feb. 12, 3,000; Mar. 29, 2,000	5,000
No. 49. Improvement of Pastures in Eastern New York and the New England States. J. S. Cotton. 10 pp. Mar. 21	12,000
No. 50. Three Much-misrepresented Sorghums. Carleton R. Ball. 14 pp. Mar. 8	6,000
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No. 52. Wart Disease of the Potato. W. A. Orton and Ethel C. Field. 11 pp. Mar. 8	3,000
No. 53. Mutative Reversions in Cotton. O. F. Cook. 18 pp. Mar. 21	2,000
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Annual Reports:	
Report of the Chief of Bureau of Plant Industry, 1909. B. T. Galloway. (From An. Rpts. of Dept., 1909). 118 pp. Dec. 1	2,500
Yearbook Extracts:	
No. 475. The Wastes of the Farm. A. F Woods. (From Ybk. 1908). 24 pp. July 23, 1,000; Nov. 13, 1,000; Jan. 23, 2,000	4,000
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Doc. 503. "A—68." Fall-breaking and the Preparation of the Seed Bed. 8 pp. Sept. 9, 80,000; Nov. 10, 50,000; Mar. 24, 50,000	180,000
Doc. 504. Publications of the Bureau of Plant Industry. 11 pp. Sept. 13	2,000
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No. 401. The Protection of Orchards in the Pacific Northwest from Spring Frosts by Means of Fires and Smudges. P. J. O'Gara. 24 pp. June 22	20,000
No. 402. Canada Bluegrass: Its Culture and Uses. R. A. Oakley. 20 pp. June 25	15,000
No. 406. Soil Conservation. W. J. Spillman. 16 pp. June 17	30,000
Indexes:	
Index to Circulars Bureau of Plant Industry Nos. 1 to 40, Inclusive, 1908–1909. Vol. 1. 10 pp. Dec. 18	200
Index to Bulletins Bureau of Plant Industry Nos. 137 to 148, Inclusive, 1909. Vol. XIX. 10 pp. Aug. 17	200

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Bulletin:	
No. 108. The Cold Storage of Small Fruits. S. H. Fulton. 28 pp. 15 cts. Mar. 25	500

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Miscellaneous Circulars:	
Doc. 334. The Morton Citrange. 4 pp. Nov. 5	500
Doc. 355. "A—52" Economize! Cut Down the Expenses of the Farm. S. A. Knapp. 5 pp. Dec. 15, 75,000; Feb. 5, 50,000; Mar. 17, 50,000; May 10, 50,000	225,000
Dec. 441. "A—65" Commercial Fertilizers: Their value and Uses. S. A. Knapp. 4 pp. Dec. 13, 75,000; Feb. 11, 50,000; Mar. 21, 50,000; May 23, 50,000	225,000
Doc. 447. American Ginseng. Rodney H. True. 3 pp. Aug. 24	5,000
Doc. 485. "A—67" The Selection of Cotton and Corn Seed for Southern Farms. S. A. Knapp. 8 pp. July 1, 50,000; Jan. 27, 50,000; May 23, 50,000	150,000
Farmers' Bulletins:	
No. 28. Second Revision. Weeds, and How to Kill Them. Lyster H. Dewey. 32 pp. July 30, 10,000; Oct. 25, 10,000; Feb. 4, 10,000; Apr. 1, 10,000; May 24, 10,000	50,000
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No. 91. Potato Diseases and Their Treatment. B. T. Galloway. 15 pp. July 27, 10,000; Dec. 17, 10,000; Feb. 25, 10,000; Apr. 15, 10,000; May 26, 10,000	50,000
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No. 113 (Revised). The Apple and How to Grow it. G. B. Brackett. 32 pp. Jan. 31, 15,000; Mar. 18, 15,000; Mar. 23, 15,000	45,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF PLANT INDUSTRY—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

Farmers' Bulletins—Continued.	Copies.
No. 118. Grape Growing in the South. S. M. Tracy. 32 pp. Nov. 2, 10,000; Mar. 13, 10,000	20,000
No. 139. Emmer: A Grain for Semiarid Regions. Mark Alfred Carleton. 15 pp. Dec. 14, 5,000; Apr. 16, 5,000	10,000
No. 140. Pineapple Growing. Peter H. Rolfs. 47 pp. Feb. 10	5,000
No. 154. The Home Fruit Garden: Preparation and Care. L. C. Corbett. 16 pp. Nov. 2, 10,000; Apr. 16, 15,000; Jan. 29, 15,000	40,000
No. 156. The Home Vineyard, with Special Reference to Northern Conditions. W. H. Ragan. 24 pp. Oct. 12, 5,000; Feb. 2, 10,000; Apr. 13, 10,000; June 3, 15,000	40,000
No. 157. The Propagation of Plants. L. C. Corbett. 23 pp. Nov. 16, 20,000; June 9, 5,000	25,000
No. 164. Rape as a Forage Crop. A. S. Hitchcock. 16 pp. Nov. 3, 5,000; Feb. 26, 5,000	10,000
No. 167. Cassava. S. M. Tracy. 31 pp. Feb. 17	5,000
No. 174. Broom Corn. C. P. Hartley. 32 pp. Nov. 8, 5,000; Feb. 14, 5,000; Mar. 24, 15,000	25,000
No. 175. Home Manufacture and Use of Unfermented Grape Juice. George C. Husmann. 15 pp. Oct. 2, 5,000; Feb. 11, 5,000; Apr. 30, 5,000	15,000
No. 176. Cranberry Culture. L. C. Corbett. 20 pp. Oct. 21, 5,000; Mar. 7, 5,000	10,000
No. 181. Pruning. L. C. Corbett. 39 pp. Oct. 4, 10,000; Dec. 7, 10,000; Feb. 23, 15,000; May 24, 10,000	45,000
No. 185. Beautifying the Home Grounds. L. C. Corbett. 24 pp Oct. 7, 10,000; Dec. 9, 10,000; Feb. 23, 10,000; Mar. 8, 15,000; Apr. 21, 15,000	60,000
No. 188. Weeds Used in Medicine. Alice Henkel. 45 pp. Oct. 7, 5,000; Dec. 6, 10,000; Apr. 13, 10,000	25,000
No. 194. Alfalfa Seed. Edgar Brown. 15 pp. Jan. 13, 10,000; Apr. 14, 15,000	25,000
No. 195. Annual Flowering Plants. L. C. Corbett. 48 pp. Feb. 21, 10,000; Apr. 11, 15,000	25,000
No. 198. Strawberries. L. C. Corbett. 24 pp. Oct. 18, 10,000; Feb. 2, 15,000; Apr. 13, 15,000; May 26, 10,000	50,000
No. 199. Corn Growing. C. P. Hartley. 31 pp. Aug. 6, 10,000; Oct. 30, 15,000; Feb. 12, 15,000; Mar. 18, 20,000; Apr. 13, 15,000; Apr. 14, 20,000	95,000
No. 204. The Cultivation of Mushrooms. B. M. Duggar. 24 pp. Dec. 15, 10,000; May 31, 10,000	20,000
No. 218. The School Garden. L. C. Corbett. 41 pp. Nov. 13, 20,000; June 1, 10,000	30,000
No. 219. Lessons from the Grain-rust Epidemic of 1904. Mark Alfred Carleton. 24 pp. Feb. 25, 5,000; May 26, 10,000	15,000
No. 220. Tomatoes. L. C. Corbett. 32 pp. Aug. 5, 10,000; Nov. 26, 10,000; Mar. 7, 10,000; May 13, 15,000	45,000
No. 221. Fungous Diseases of the Cranberry. C. L. Shear. 16 pp. June 2	5,000
No. 224. Canadian Field Peas. Thomas Shaw. 16 pp. Nov. 11, 10,000; June 2, 5,000	15,000
No. 229. The Production of Good Seed Corn. C. P. Hartley. With an appendix on Selection and Care of Seed Corn by Herbert J. Webber. 23 pp. Sept. 3, 10,000; Dec. 7, 10,000; Mar. 9, 15,000; Apr. 29, 20,000	55,000
No. 231. Spraying for Cucumber and Melon Diseases. W. A. Orton. 24 pp. Sept. 2, 10,000; Feb. 25, 5,000; May 24, 10,000; June 1, 5,000	30,000
No. 238. Citrus Fruit Growing in the Gulf States. Peter H. Rolfs. 48 pp. Dec. 31, 5,000; Apr. 14, 5,000	10,000
No. 242. An Example of Model Farming. W. J. Spillman. 16 pp. Dec. 27, 15,000; Mar. 12, 15,000; May 26, 15,000	45,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF PLANT INDUSTRY—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

Farmers' Bulletins—Continued.	Copies.
No. 243. Fungicides and Their Use in Preventing Diseases of Fruits. M. B. Waite. 32 pp. Aug. 11, 10,000; Mar. 4, 10,000; June 10, 5,000	25,000
No. 245. Renovation of Worn-out Soils. W. J. Spillman. 16 pp. July 28, 5,000; Oct. 9, 5,000; Nov. 26, 10,000; Feb. 12, 10,000; Apr. 25, 10,000: June 6, 10,000	50,000
No. 246. Saccharine Sorghums for Forage. Carleton R. Ball. 37 pp. Dec. 31, 5,000; May 16, 10,000; May, 17, 5,000	20,000
No. 248. The Lawn. L. C. Corbett. 20 pp. Dec. 11, 15,000; Apr. 8, 15,000	30,000
No. 250. The Prevention of Stinking Smut of Wheat and Loose Smut of Oats. Walter T. Swingle. 16 pp. Oct. 2, 5,000; Dec. 29, 5,000; Apr. 15, 5,000; June 2, 5,000	20,000
No. 253. The Germination of Seed Corn. J. W. T. Duvel. 16 pp. Feb. 12, 15,000; May 26, 10,000	25,000
No. 254. Cucumbers. L. C. Corbett. 32 pp. Jan. 7, 5,000; Mar. 31, 10,000	15,000
No. 255. The Home Vegetable Garden. W. R. Beattie. 47 pp. Dec. 3, 15,000; Feb. 28, 15,000; Mar. 5, 20,000; Mar. 29, 40,000; Apr. 30, 40,000	130,000
No. 260. Seed of Red Clover and Its Impurities. Edgar Brown and F. H. Hillman. 24 pp. Mar. 8	5,000
No. 271. Forage-crop Practices in Western Oregon and Western Washington. Byron Hunter. 30 pp. June 9	15,000
No. 272. A Successful Hog and Seed Corn Farm. W. J. Spillman. 16 pp. Oct. 21, 10,000; Feb. 26, 10,000; Apr. 22, 10,000; June 3, 15,000	45,000
No. 274. Flax Culture. (From a report of H. L. Bolley.) 38 pp. June 2	5,000
No. 278. Leguminous Crops for Green Manuring. C. V. Piper. 29 pp. Oct. 18, 10,000; Feb. 26, 10,000; May 3, 10,000	30,000
No. 279. A Method of Eradicating Johnson Grass. J. S. Cates. 16 pp. Mar. 8, 5,000; June 2, 5,000	10,000
No. 280. A Profitable Tenant Dairy Farm. Lyman Carrier. 16 pp. Feb. 12	10,000
No. 282. Celery. W. R. Beattie. 36 pp. Aug. 14, 10,000; Feb. 25, 10,000; June 1, 10,000	30,000
No. 283. Spraying for Apple Diseases and the Codling Moth in the Ozarks. W. M. Scott and A. L. Quaintance. 44 pp. Oct. 6, 5,000; Dec. 10, 5,000; Feb. 26, 10,000	20,000
No. 285. The Advantages of Planting Heavy Cotton Seed. Herbert J. Webber and E. B. Boykin. 16 pp. Oct. 18, 5,000; Feb. 14, 10,000	15,000
No. 288. The Nonsaccharine Sorghums. C. W. Warburton. 30 pp. Nov. 12	10,000
No. 289. Beans. L. C. Corbett. 30 pp. Feb. 21, 10,000; June 1, 10,000	20,000
No. 291. Evaporation of Apples. H. P. Gould. 40 pp. Feb. 25	5,000
No. 292. Cost of Filling Silos. Lyman Carrier. 15 pp. Jan. 8, 5,000; May 26, 20,000	25,000
No 294. Farm Practice in the Columbia Basin Uplands. Byron Hunter. 32 pp. Mar. 14	5,000
No. 299. Diversified Farming Under the Plantation System. D. A. Brodie and C. K. McClelland. 16 pp. July 29, 5,000; Jan. 10, 10,000; Mar. 28, 10,000; June 3, 10,000	35,000
No. 300. Some Important Grasses and Forage Plants for the Gulf Coast States. S. M. Tracy. 15 pp. Oct. 4, 5,000; Feb. 26, 10,000	15,000
No. 301. Home-grown Tea. George F. Mitchell. 16 pp. Jan. 8	5,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF PLANT INDUSTRY—Continued.

EARLIER PUBLICATIONS REPRINTED—Continued.

	Copies.
Farmers' Bulletins—Continued.	
No. 302. Sea Island Cotton: Its Culture, Improvement, and Diseases. W. A. Orton. 48 pp. Dec. 16	10,000
No. 304. Growing and Curing Hops. W. W. Stockberger. 39 pp. Feb. 25, 10,000; June 6, 10,000	20,000
No. 310. A Successful Alabama Diversification Farm. M. A. Crosby, J. F. Duggar, and W. J. Spillman. 24 pp. May 13	20,000
No. 312. A Successful Southern Hay Farm. Harmon Benton. 15 pp. Nov. 9, 10,000; Apr. 12, 20,000; Apr. 21, 10,000	40,000
No. 313. Harvesting and Storing Corn. C. P. Hartley. 31 pp. Oct. 16, 10,000; Jan. 7, 10,000; May 3, 10,000; June 8, 5,000	35,000
No. 314. A Method of Breeding Early Cotton to Escape Boll-Weevil Damage. R. L. Bennett. 30 pp. Jan. 14, 10,000; June 10, 15,000	25,000
No. 315. Progress in Legume Inoculation. Karl F. Kellermann and T. R. Robinson. 20 pp. Oct. 18, 5,000; Jan 8, 5,000; May 16, 10,000	20,000
No. 318. Cowpeas. H. T. Nielson. 30 pp. Feb. 24, 10,000; Apr. 22, 15,000	25,000
No. 319. Demonstration Work in Cooperation with Southern Farmers. S. A. Knapp. 24 pp. July 15, 25,000; Mar. 21, 15,000; June 8, 10,000	50,000
No. 322. Milo as a Dry-Land Grain Crop. Carleton R. Ball and Arthur H. Leidigh. 23 pp. Feb. 25, 10,000; June 6, 10,000	20,000
No. 323. Clover Farming on the Sandy Jack-Pine Lands of the North. C. B. Smith. 24 pp. Jan. 24	10,000
No. 324. Sweet Potatoes. W. R. Beattie. 39 pp. Nov. 1, 10,000; Feb. 24, 10,000; Apr. 25, 15,000	35,000
No. 325. Small Farms in the Corn Belt. J. A. Warren. 31 pp. Jan. 19, 10,000; Apr. 19, 15,000	25,000
No. 326. Building Up a Run-down Cotton Plantation. C. A. Brodie. 24 pp. Dec. 6, 10,000; June 11, 10,000	20,000
No. 331. Forage Crops for Hogs in Kansas and Oklahoma. C. R. Quinn. 24 pp. Apr. 22	10,000
No. 333. Cotton Wilt. W. A. Orton. 24 pp. Sept. 13, 10,000; June 4, 10,000	20,000
No. 337. Cropping Systems for New England Dairy Farms. L. G. Dodge. 24 pp. Feb. 18	15,000
No. 339. Alfalfa. J. M. Westgate. 48 pp. Aug. 26, 10,000; Oct. 22, 15,000; Dec. 9, 10,000; Mar. 2, 15,000; Mar. 12, 30,000; May 26, 20,000	100,000
No. 343. The Cultivation of Tobacco in Kentucky and Tennessee. W. H. Scherffius, H. Woosley, and C. A. Mahan. 31 pp. Oct. 18, 10,000; June 10, 10,000	20,000
No. 354. Onion Culture. W. R. Beattie. 39 pp. Feb. 9, 10,000; May 13, 10,000	20,000
No. 355. A Successful Dairy and Poultry Farm. W. J. Spillman. 40 pp. July 19, 10,000; Aug. 10, 20,000; Oct. 4, 20,000; Feb. 25, 10,000; Apr. 4, 40,000; June 9, 10,000	110,000
No. 356. Peanuts. W. R. Beattie. 40 pp. Aug. 14, 10,000; Dec. 15, 10,000; Mar. 7, 15,000; Apr. 19, 10,000; June 8, 10,000	55,000
No. 361. Meadow Fescue: Its Culture and Uses. H. N. Vinall. 24 pp. July 31	15,000

DIVISION OF PUBLICATIONS.

NEW PUBLICATIONS.

Circulars:	
No. 2 (Revised). Publications for Free Distribution. C. H. Greathouse. 45 pp. July 26, 3,000; Nov. 3, 15,000; May 21, 2,500	20,500
No. 3 (Revised). Publications for Sale. C. H. Greathouse. 85 pp. Nov. 2	1,500

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Publications issued during the year ended June 30, 1910, etc.—Continued.

DIVISION OF PUBLICATIONS—Continued.

NEW PUBLICATIONS—Continued.

	Copies.
Circulars—Continued.	
No. 4 (Revised). Farmers' Bulletin Subject Index (Including No. 382). C. H. Greathouse. 36 pp. Jan. 21	5,000
No. 6 (Revised). Publications of the United States Department of Agriculture and How they are Distributed. The Editor. 3 pp. Oct. 12, 1,500; Dec. 17, 2,500; Jan. 21, 5,000	9,000
Annual Report:	
Report of the Editor and Chief. Jos. A. Arnold. (From An. Rpts. of Dept., 1909.) 66 pp. Dec. 6	500
Yearbook Extract:	
No. 497. A Directory for Farmers. (From Ybk. 1908.) 29 pp. Sept. 8	2,500
Monthly List of Publications:[a]	
June, 1909. Foreign. 4 pp. July 26	5,000
May–June, 1909. Domestic. 4 pp. July 13	235,000
July, 1909. Foreign. 4 pp. Aug. 20	5,000
July, 1909. Domestic. 4 pp. Aug. 9	240,000
August, 1909. Foreign. 4 pp. Sept. 22	5,000
August, 1909. Domestic. 4 pp. Sept. 10	240,000
September, 1909. Foreign. 4 pp. Oct. 22	5,000
September, 1909. Domestic. 4 pp. Oct. 12	250,000
October, 1909. Foreign. 4 pp. Nov. 19	5,000
October, 1909. Domestic. 4 pp. Nov. 10	255,000
November, 1909. Foreign. 4 pp. Dec. 17	5,000
November, 1909. Domestic. 4 pp. Dec. 7	260,000
December, 1909. Foreign. 4 pp. Jan. 24	5,000
December, 1909. Domestic. 4 pp. Jan. 7	275,000
January, 1910. Foreign. 4 pp. Feb. 21	5,000
January, 1910. Domestic. 4 pp. Feb. 7	310,000
February, 1910. Foreign. 4 pp. Mar. 19	5,000
February, 1910. Domestic. 4 pp. Mar. 7	500,000
March, 1910. Foreign. 4 pp. Apr. 19	5,000
April, 1910. Foreign. 4 pp. May. 21	5,000
March–April, 1910. Domestic. 4 pp. May 11	220,000
May, 1910. Foreign. 4 pp. June 20	5,000
Miscellaneous Circulars:	
Table of Contents for Binding with Farmers' Bulletins Nos. 201 to 225, Inclusive. 6 pp. Nov. 23	1,000
Index for Binding with Farmers' Bulletins 201 to 225, Inclusive. 12 pp. Nov. 23	1,000
Table of Contents for Binding with Farmers' Bulletins Nos. 226 to 250, Inclusive. 8 pp. Nov. 23	500
Index for Binding with Farmers' Bulletins Nos. 226 to 250, Inclusive. 15 pp. Nov. 23	500
Table of Contents for Binding with Farmers' Bulletins Nos. 326 to 350, Inclusive. 7 pp. Oct. 27	2,500
Index for Binding with Farmers' Bulletins Nos. 326 to 350, Inclusive. 10 pp. Oct. 27	2,500
Table of Contents for Binding with Farmers' Bulletins Nos. 351 to 375, Inclusive. 7 pp. Mar. 16	2,500
Index for Binding with Farmers' Bulletins Nos. 351 to 375, Inclusive. 19 pp. Mar. 16	2,500
Lists of Farmers' Bulletins. 4 pp. July 22, 5,000; July 31, 50,000; Aug. 10, 60,000; Sept. 9, 50,000; Oct. 22, 50,000; Dec. 22, 50,000; Jan. 13, 100,000; Jan. 24, 100,000; Feb. 15, 100,000; Feb. 17, 100,000; Feb. 26, 150,000; Mar. 26, 100,000; Apr. 5, 100,000; May 11, 150,000; May 26 100,000; May 31, 50,000	1,315,000

[a] Two lists are issued, one for a wide distribution in the United States, the other for a limited distribution in foreign countries.

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Publications issued during the year ended June 30, 1910, etc.—Continued.

DIVISION OF PUBLICATIONS—Continued.

Earlier Publications Reprinted.

	Copies.
Farmers' Bulletins:	
No. 61. Asparagus Culture. R. B. Handy. 39 pp. Nov. 2, 10,000; Feb. 25, 10,000	20,000
No. 62. Marketing Farm Produce. George G. Hill. 41 pp. Oct. 25, 10,000; Feb. 17, 10,000; May 13, 10,000	30,000
No. 98. Suggestions to Southern Farmers. Prepared in the Division of Publications. 48 pp. July 7	10,000
No. 126. Practical Suggestions for Farm Buildings. George G. Hill. 48 pp. Oct. 12, 5,000; Dec. 9, 10,000; Feb. 23, 10,000; May 27, 10,000	35,000
No. 150. Clearing New Land. Franklin Williams, Jr. 24 pp. Oct. 15, 5,000; Jan. 29, 5,000; Apr. 13, 10,000	20,000

OFFICE OF PUBLIC ROADS.

New Publications.

Circular:	
No. 91. Sand-clay and Earth Roads in the Middle West. W. L. Spoon. 31 pp. Mar. 21	20,000
Report:	
Report of the Director of the Office of Public Roads. Logan Waller Page. (From An. Rpts. of Depts., 1909.) 30 pp. Nov. 26	2,500
Yearbook Extract:	
No. 513. Information in Regard to Fabricated Wire Fences, and Hints to Purchasers. Allerton S. Cushman. (From Ybk., 1909.) 8 pp. May 31	1,200
Miscellaneous Circular:	
Exhibit of the Office of Public Roads. Alaska-Yukon-Pacific Exhibition. 23 pp. Sept. 10	7,500
Farmers' Bulletin:	
No. 403. The Construction of Concrete Fence Posts. Prepared in the Office of Public Roads. 31 pp. May 24	30,000

Earlier Publications Reprinted.

Bulletins:	
No. 30. The Corrosion of Iron. Allerton S. Cushman. 35 pp. 10 cts. Oct. 18	500
No. 31. The Examination and Classification of Rocks for Road Building. Edwin C. E. Lord. 29 pp. 15 cts. Mar. 31	500
Circulars:	
No. 88. Publications of the Office of Public Roads. Compiled by William W. Sniffin. 7 pp. July 29, 2,500; Oct. 28, 3,000	5,500
No. 90. Progress Reports of Experiments in Dust Prevention, Road Preservation, and Road Construction. Logan Waller Page. 23 pp. Nov. 4	2,000
Yearbook Extracts:	
No. 204. Selection of Materials for Macadam Roads. Logan Waller Page. (From Ybk. 1900.) 11 pp. Oct. 9	500
No. 350. Practical Road Building in Madison County, Tenn. Sam. C. Lancaster. (From Ybk. 1904.) 20 pp. Sept. 10	2,000
Farmers' Bulletins:	
No. 235. Cement Mortar and Concrete: Preparation and Use for Farm Purposes. Philip L. Wormley, Jr. 23 pp. Aug. 26, 10,000; Feb. 24. 10,000; Apr. 7, 10,000; June 9, 15,000	45,000
No. 239. The Corrosion of Fence Wire. Allerton S. Cushman. 31 pp. June 1	30,000
No. 311. Sand-clay and Burnt-clay Roads. William L. Spoon. 20 pp. May 28	15,000
No. 321. The Use of the Split-log Drag on Earth Roads. D. Ward King. 16 pp. Nov. 13, 15,000; Feb. 28, 15,000; May 28, 10,000	40,000
No. 338. Macadam Roads. Austin B. Fletcher. 48 pp. Nov. 29, 15,000; Feb. 26, 10,000; June 4, 10,000	35,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF SOILS.

New Publications.

	Copies.
Bulletins:	
No. 57. A Study of Crop Yields and Soil Composition in Relation to Soil Productivity. Milton Whitney. 127 pp. 20 cts. Oct. 8	1,000
No. 58. The Composition of Commercial Fertilizers. Milton Whitney. 39 pp. 10 cts. May 11	2,500
No. 59. Heat Transference in Soils. Harrison E. Patten. 54 pp. 10 cts. Sept. 28	3,000
No. 60. A Preliminary Report on the Volusia Soils, Their Problems and Management. 22 pp. 20 cts. Sept. 30	3,000
No. 62. Fertilizers for Cotton Soils. Milton Whitney. 24 pp. 5 cts. Sept. 29, 3,000; Dec. 29, 500	3,500
No. 63. Reference List of the Electric Fixation of Atmospheric Nitrogen and the Use of Calcium Cyanamid and Calcium Nitrate on Soils. Compiled by Stephen Conrad Stuntz. 89 pp. 10 cts. Jan. 27	2,000
No. 64. Fertilizers for Corn Soils. Milton Whitney. 31 pp. 5 cts. May 3	2,500
No. 65. Fertilizers for Potato Soils. Milton Whitney. 19 pp. 5 cts. May 9	2,500
No. 66. Fertilizers for Wheat Soils. Milton Whitney. 48 pp. 10 cts. May 28	2,000
No. 67. Fertilizers on Soils Used for Oats, Hay, and Miscellaneous Crops. Milton Whitney. 73 pp. 10 cts. June 18	2,500
No. 69. A Review of the Phosphate Fields of Idaho, Utah, and Wyoming. W. H. Waggaman. 48 pp. 10 cts. June 24	2,500
Circulars:	
No. 20. Soils of Pender County, N. C. A Preliminary Report. 16 pp. Jan. 14	2,500
No. 21. Soils in the Vicinity of Brunswick, Ga. A Preliminary Report. 21 pp. Feb. 19	2,500
Report:	
Annual Report of the Chief of the Bureau of Soils, 1909. Milton Whitney. (From An. Rpts. of Dept., 1909.) 20 pp. Dec. 8	200
Yearbook Extract:	
No. 516. Agriculture in the Coal Regions of Southwestern Pennsylvania. H. J. Wilder. (From Ybk., 1909.) 12 pp. June 17	1,000

Earlier Publications Reprinted.

Bulletin:	
No. 55. Soils of the United States, Based upon the Work of the Bureau of Soils, to Jan. 1, 1908. Milton Whitney. 43 pp. 45 cts. Aug. 23	1,000
Yearbook Extract:	
No. 415. The Use of Soil Surveys. J. A. Bonsteel. (From Ybk., 1906.) 8 pp. Mar. 31	1,000
Farmers' Bulletins:	
No. 60. 2d Revision. Methods of Curing Tobacco. Milton Whitney. 23 pp. Oct. 15, 10,000; June 11, 10,000	20,000
No. 82. The Culture of Tobacco. O. C. Butterweck. 24 pp. Feb 1	10,000
No. 83. Tobacco Soils. Milton Whitney. 23 pp. Jan. 13, 5,000; May 13, 10,000	15,000
No. 88. Alkali Lands. Milton Whitney and T. H. Means. 24 pp. Nov. 11, 5,000; Jan. 29, 5,000; June 2, 5,000	15,000
No. 257. Soil Fertility. Milton Whitney. 39 pp. Dec. 28, 10,000; Mar. 31, 15,000; June 4, 15,000	40,000
No. 266. Management of Soils to Conserve Moisture, with Special Reference to Semiarid Conditions. George H. Failyer. 32 pp. Oct. 6, 10,000; Feb. 9, 10,000; Apr. 30, 10,000	30,000

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Publications issued during the year ended June 30, 1910, etc.—Continued.

BUREAU OF STATISTICS.

NEW PUBLICATIONS.

	Copies.
Bulletins:	
No. 51. Foreign Trade of the United States in Forest Products, 1851–1908. 32 pp. 5 cts. Dec. 6	4,500
No. 74. Imports of Farm Products into the United States, 1851–1908. 62 pp. 10 cts. Feb. 5	4,500
No. 75. Exports of Farm Products from the United States, 1851–1908. 66 pp. 10 cts. Feb. 5	4,500
No. 76. Imports of Farm and Forest Products, 1906–1908, by Countries from which Consigned. Prepared by Division of Production and Distribution. 65 pp. 10 cts. Oct. 29	3,600
No. 77. Exports of Farm and Forest Products, 1906–1908, by Countries to Which Consigned. Prepared by the Division of Production and Distribution. 91 pp. 10 cts. Feb. 8	3,600
Circular:	
No. 18. Tobacco Districts and Types. J. P. Killebrew. 16 pp. Nov. 26	5,500
Report:	
Annual Report of the Chief of the Bureau of Statistics for 1909. Victor H. Olmsted. (From An. Rpts. of Dept., 1909.) 16 pp. Oct. 8	1,000
Yearbook Extracts:	
No. 498. Agricultural Statistics for 1908. (From Ybk. 1908.) 190 pp. Sept. 17	50,000
No. 502. Methods and Cost of Marketing. Frank Andrews. (From Ybk. 1909.) 12 pp. June 23	3,000
Crop Reporter (a two-column quarto devoted to Agricultural Statistics):	
Vol. 11, No. 7, July, 1909. 4 pp. July 13	135,000
Vol. 11, No. 8, August, 1909. 4 pp. Aug. 14	135,000
Vol. 11, No. 9, September, 1909. 4 pp. Sept. 14	135,000
Vol. 11, No. 10, October, 1909. 4 pp. Oct. 14	135,000
Vol. 11, No. 11, November, 1909. 4 pp. Nov. 11	135,000
Vol. 11, No. 12, December, 1909. 4 pp. Dec. 11	135,000
Vol. 11, No. 12, Supplement, December, 1909. 4 pp. Dec. 20	138,000
Vol. 12, No. 1, January, 1910. 4 pp. Jan. 14	135,000
Vol. 12, No. 2, February, 1910. 4 pp. Feb. 8	135,000
Vol. 12, No. 3, March, 1910. 4 pp. Mar. 15	135,000
Vol. 12, No. 4, April, 1910. 4 pp. Apr. 13	140,000
Vol. 12, No. 5, May, 1910. 4 pp. May 14	145,000
Vol. 12, No. 6, June, 1910. 4 pp. June 11	140,000
Crop Reports:	
A Summary of each Formal Crop Report, 2 pp. (25 nos. of 1,500 copies of each) aggregating	37,500

WEATHER BUREAU.

NEW PUBLICATIONS.[a]

Bulletins of the Mount Weather Observatory [b] ***(Quarterly):***	
Vol. II, Part 2. 108 pp. July 15	1,000
Vol. II, Part 3. 76 pp. Jan. 6	1,000
Vol. II, Part 4. 104 pp. June 10	1,000
Vol. II, Part 5. 32 pp. May 26	1,250
Vol. II, Part 6. 65 pp. June 14	1,250
Report:	
Annual Report of the Chief of the Weather Bureau for 1909, Willis L. Moore. (From An. Rpts. of Dept., 1909.) 43 pp. Nov. 26	1,000

[a] This list contains only the important publications issued by the Washington Office of the Weather Bureau. For an account of other publications, see page 6.

[b] Subscription price 25 cents per number, or $1 per year.

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Publications issued during the year ended June 30, 1910, etc.—Continued.

WEATHER BUREAU—Continued.

NEW PUBLICATIONS—Continued.

	Copies.
Yearbook Extracts: [a]	
No. 481. The So-called Change of Climate in the Semiarid West. Richard H. Sullivan. (From Ybk., 1908.) 16 pp. Nov. 18	250
No. 492. Instructions for Making Weather Observations on Farm. Dewey A. Seeley. (From Ybk., 1908.) 12 pp. Nov. 24	250
No. 522. How Farmers May Utilize the Special Warnings of the Weather Bureau. Charles F. von Hermann. (From Ybk., 1909.) 16 pp. June 17	1,000
Miscellaneous:	
Instructions for Making Weather Observations on the Farm. 13 pp. Aug. 17	500
No. 415. Instructions to Special River and Rainfall Observers of U. S. Weather Bureau. 47 pp	1,000
River Stages, Part IX. For the Years 1907 and 1908. H. C. Frankenfield. 368 pp. $4.95. Mar. 9	750
No. 423. Studies of the Vortices of the Atmosphere of the Earth. By Frank H. Bigelow. 46 pp	500
Daily Weather Map,[b] Washington, D. C., average daily edition 1,200	469,000
Monthly Weather Review [c] (quarto):	
Vol. XXXVII, No. 4. April, 1909. 51 pp	4,600
Vol. XXXVII, No. 5. May, 1909. 48 pp	4,600
Vol. XXXVII, No. 6. June, 1909. 44 pp	4,600
Vol. XXXVII, No. 7. July, 1909. 146 pp	1,500
Vol. XXXVII, No. 8. August, 1909. 140 pp	1,500
Vol. XXXVII, No. 9. September, 1909. 146 pp	1,500
Vol. XXXVII, No. 10. October, 1909. 144 pp	1,500
Vol. XXXVII, No. 11. November, 1909. 156 pp	1,500
Vol. XXXVII, No. 12. December, 1909. 158 pp	1,500
Vol. XXXVIII, No. 1. January, 1910. 168 pp	1,500
Vol. XXXVIII, No. 2. February, 1910. 160 pp	1,500
Vol. XXXVIII, No. 3. March, 1910. 178 pp	1,500
Vol. XXXVIII, No. 4. April, 1910. 162 pp	1,500
National Weather Bulletin [d] (Reporting Temperature and Rainfall with a Summary of Weather Conditions by Sections throughout the United States):	
No. 12, for the week ended July 7	2,950
No. 13, for the week ended July 14	2,950
No. 14, for the week ended July 21	2,950
No. 15, for the week ended July 28	2,950
No. 16, for the week ended August 4	2,950
No. 17, for the week ended August 10	2,950
No. 18, for the week ended August 17	2,950
No. 19, for the week ended August 24	2,950
No. 20, for the week ended August 31	2,950
No. 21, for the week ended September 7	2,950
No. 22, for the week ended September 14	2,950
No. 23, for the week ended September 21	2,950
No. 24, for the week ended September 28	2,950
No. 25, for the month of October	2,950

[a] Contributed by the Weather Bureau, but issued by the Department through the Division of Publications.

[b] A single sheet (19 by 24 inches) printed on one side, containing a weather map, a table of temperature, rainfall, and other data for the entire United States, and forecasts for the eastern districts. Subscription price, 25 cents per month, or $2.50 per year.

[c] Subscription price, 35 cents per number, or $4.00 per year.

[d] A single sheet (19 by 24 inches) printed on one side only, containing charts, tables, and reading matter, issued weekly during the crop-growing season and monthly during the remainder of the year. Subscription price, 25 cents per year.

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Publications issued during the year ended June 30, 1910, etc.—Continued.

WEATHER BUREAU—Continued.

NEW PUBLICATIONS—Continued.

	Copies.
National Weather Bulletin—Continued.	
No. 26, for the month of November	2,950
No. 27, for the month of December	2,950
No. 1, for the month of January	2,950
No. 2, for the month of February	2,950
No. 3, for the month of March	2,950
No. 4, for the month of April	2,950
No. 5, for the week ended May 16	2,950
No. 6, for the week ended May 23	2,950
No. 7, for the week ended May 30	2,950
No. 8, for the week ended June 6	2,950
No. 9, for the week ended June 13	2,950
No. 10, for the week ended June 20	2,950
No. 11, for the week ended June 27	2,950
Snow and Ice Bulletins: [a]	
December 7, 1909	1,350
December 14, 1909	1,350
December 21, 1909	1,350
December 28, 1909	1,350
January 4, 1910	1,350
January 11, 1910	1,350
January 18, 1910	1,350
January 25, 1910	1,350
February 2, 1910	1,350
February 8, 1910	1,350
February 16, 1910	1,350
February 23, 1910	1,350
March 1, 1910	1,350
March 8, 1910	1,350
March 15, 1910	1,350
March 22, 1910	1,350
Farmers' Bulletins:	
No. 104 (Revised). Notes on Frost. E. B. Garriott. 31 pp. July 17, 5,000; Nov. 3, 10,000; Mar. 24, 5,000	20,000
No. 367. Lightning and Lightning Conductors. Alfred J. Henry. 20 pp. Aug. 18, 20,000; Jan. 3, 10,000	30,000

[a] A single sheet (12 by 19 inches) printed on one side, containing map, table, and descriptive matter; issued weekly during the season of ice and snow. Subscription price, 25 cents per year.

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REPORT OF THE CHIEF OF THE BUREAU OF STATISTICS.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF STATISTICS,
Washington, D. C., August 31, 1910.

SIR: I have the honor to submit herewith the report of the Bureau of Statistics for the fiscal year ended June 30, 1910.

Respectfully,

VICTOR H. OLMSTED,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

INTRODUCTION.

During the fiscal year which closed June 30, 1910, the Bureau of Statistics pursued the same general lines of work and followed the same general methods as characterized its operations during preceding years. These have been fully and explicitly set forth and described in annual reports relating to the years 1909, 1908, and other previous years, and it would appear unnecessary to reiterate the information already supplied. Those who may be interested in more detailed information than is set forth herein can be supplied with copies of the reports above referred to. A mere outline of the organization and character of the work performed is deemed sufficient at this time.

ORGANIZATION.

Briefly, the Bureau is organized in three main divisions: The Division of Production and Distribution, the Editorial Division and Library, and the Division of Domestic Crop Reports. Nearly all work accomplished by the Bureau is in connection with or performed by these divisions, which also, occasionally, make statistical tabulations or computations for other Bureaus of the Department. The corps of special field agents, State statistical agents, and the various classes of voluntary crop correspondents, numbering approximately 130,000, supply data for use in the compilation of domestic crop reports; the Editorial Division and Library performs functions clearly indicated by its name; and the Division of Production and Distribution compiles statistical data and prepares reports along lines shown by the statement given farther on covering the work accomplished by it during the year.

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The appropriations available for carrying on the operations of this Bureau were no greater for the year ended June 30, 1910, than for the two preceding years; and for the current year they have not been increased; consequently it has been difficult to increase the scope or expand the detail necessary to an enlargement of the collection and compilation of agricultural statistics. Nevertheless, some additions have been made to our work during the year, and considerable strides have been taken in the way of systematizing the work, and in verifying or modifying results by utilizing the best comparative data obtainable.

CHANGES IN THE MONTHLY CROP REPORTS.

During the fiscal year 1910 the following changes were made in the monthly crop reports of this Bureau:

On September 1, 1909, for the first time an inquiry was made concerning the quantity of barley of the preceding year's growth on farms September 1.

In the November schedule the average weight of a measured bushel of wheat, of corn, of oats, and of barley was asked, these questions hitherto having been asked in December, except that the weight of barley was reported for the first time. In November, also, inquiry was made for the first time as to the quality of apples.

Inquiry relating to the production of rice was made in the December schedule, instead of in November as previously, and the acreage of rice harvested was also asked for the first time in December.

Commencing with February, 1910, there was inaugurated a special monthly schedule of inquiry concerning the monthly prices of numerous farm products, including rice, clover seed, tobacco, sweet potatoes, cabbages, onions, beans, apples, peaches, pears, quinces, cranberries, broom corn, oranges, lemons, hops, peanuts, wool, milk, honey, milch cows, veal calves, beef cattle, sheep, lambs, hogs, horses, and cost to farmers of bran and cotton seed, in addition to continuing the regular monthly inquiry concerning the prices of the staple products of corn, wheat, oats, barley, rye, buckwheat, potatoes, flax, hay, eggs, butter, and poultry.

In March, for the first time, the stocks of barley on farms March 1 were asked, also the percentage of the barley crop shipped out of the county where grown.

In April, 1910, the schedule included for the first time an inquiry concerning the mortality of spring lambs from disease and exposure.

During the crop season of 1910 the cotton schedules included for the first time an inquiry concerning the condition of the crop in comparison with condition on same date of preceding year, this question being asked in addition to the regular question as to condition compared with a normal.

During the year the regular monthly crop reports included the following items:

July 1, 1909, inquiry relating to acreage and condition of corn, potatoes, tobacco, flax, rice, percentage of wheat on farms, condition of winter wheat, spring wheat, oats, barley, rye, apples, hay, timothy, clover for hay, alfalfa, millet, spring pasture, kafir corn, Canadian or English field peas, cowpeas, bluegrass for seed, acreage and condition of sweet potatoes, condition of tomatoes, cabbages, onions,

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beans (both dry and lima), peaches, grapes, pears, blackberries, raspberries, percentage production of strawberries, condition of watermelons, cantaloupes, oranges, lemons, hemp, broom corn, sugar cane, acreage and condition of sorghum, sugar beets, hops, peanuts, and average weight per fleece of wool.

In August, inquiry concerning condition of corn, spring wheat, oats, barley, rye, buckwheat, potatoes, tobacco, flax for seed, rice, apples, hay, timothy, alfalfa, millet, pasture, kafir corn, Canadian or English field peas, cowpeas, bluegrass for seed, sweet potatoes, tomatoes, cabbages, onions, beans (both dry and lima), peaches, grapes, pears, watermelons, cantaloupes, oranges, lemons, hemp, broom corn, sugar cane, sorghum, sugar beets, hops, peanuts; average yield per acre and quality of winter wheat; percentage of old crop of oats on hand on August 1; acreage of buckwheat and hay; percentage production and quality of clover for hay; percentage production of blackberries and raspberries.

In the September schedule, inquiries relating to condition of corn, spring wheat, oats, barley, buckwheat, potatoes, tobacco, flax for seed, rice, apples, stock hogs, clover for seed, millet, kafir corn, Canadian or English field peas, cowpeas, sweet potatoes, tomatoes, cabbages, onions, beans (both dry and lima), grapes, pears, watermelons, cranberries, oranges, lemons, hemp, broom corn, sugar cane, sorghum, sugar beets, hops, peanuts; percentage of old crop of barley on hand September 1; acreage, yield, and quality of rye; number of stock hogs on hand September 1 as per cent of preceding year; yield and quality of hay; acreage as per cent of preceding year of clover seed; production percentage of alfalfa, bluegrass for seed, peaches, cantaloupes.

In October, questions relating to condition of corn, buckwheat, potatoes, tobacco, flaxseed, rice, apples, cowpeas, sweet potatoes, grapes, pears, cranberries, oranges, lemons, sugar cane, sorghum, sugar beets, peanuts; yield and quality of spring wheat, oats, barley; production in percentage of clover seed, millet (hay and seed separately), kafir corn, Canadian or English field peas (grain and forage separately), tomatoes, cabbages, onions, beans (both dry and lima), watermelons, hemp, broom corn; yield per acre and quality of hops.

In November, condition of oranges, lemons, sugar cane, sugar beets; yield and quality of corn, buckwheat, potatoes, tobacco, flaxseed; percentage of old corn crops on farms November 1; average weight per measured bushel of winter wheat, spring wheat, oats; production in percentage and quality of apples; production in percentage (grain and fodder separately) of kafir corn, and percentage of the grain used for feeding purposes; production in percentage of cowpeas (grain and forage separately), and the percentage of the crop plowed under; yield per acre and quality of sweet potatoes; production in percentages of grapes, pears, cranberries, peanuts; average yield per acre of sorghum sirup.

In December, the acreage and condition of winter wheat and rye sown in fall of 1909; acreage harvested, yield, and quality of rice; production in percentages of oranges, lemons, sugar cane; acreage harvested of sugar beets compared with a year ago, their production in percentage, average yield per acre, and average yield of sugar per acre of beets.

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In January, 1910, inquiries relating to the number of horses, and prices per head of those under 1 year, between 1 and 2 years, and 2 years and over; similar inquiries concerning mules; number and average price per head of milch cows; number of other cattle, and average price per head of those under 1 year, between 1 and 2, and 2 years old and over; number of sheep, average price per head of those under 1 year, of ewes 1 year old and over, of rams and wethers 1 year old and over; number of swine, and average price per head.

On March 1, inquiries concerning stocks of corn, wheat, oats, and barley on hand March 1, percentage of the total crop which will be moved out during the season from the county where grown, and the percentage of the corn crop which was of merchantable quality.

In April, inquiry concerning the condition of winter wheat and rye; the mortality during the year of horses from disease, of cattle from disease and from exposure, separately, of sheep from disease and from exposure, separately, of spring lambs from both disease and exposure combined, of swine from disease; number of breeding sows in comparison with a year ago; the condition of horses, cattle, sheep, and swine on April 1.

In May, inquiry concerning the condition of winter wheat, rye, meadow mowing lands, spring pasture, percentage of winter-wheat acreage abandoned, the percentage of the hay crop remaining on farms May 1 and the percentage of the crop which will be moved off the farm during the season, the percentage of spring plowing done to May 1.

In June, inquiries concerning condition of winter wheat, spring wheat, oats, barley, rye, apples, hay, clover for hay, alfalfa, spring pasture, Canadian or English field peas, bluegrass for seed, cabbages, onions, lima beans, peaches, pears, blackberries, raspberries, watermelons, cantaloupes, hemp, sugar cane, sugar beets; acreage of spring wheat, oats, barley; acreage percentage of a year ago of clover for hay and of sugar cane; production in percentage of asparagus.

The acreage and condition of the cotton crop was reported upon as of May 25; and the condition of the growing crop as of the 25th of June, July, August, and September; while the yield of lint cotton was reported upon on November 25.

The following special-crop inquiries were made during the year:

Stocks of potatoes in hands of growers and in hands of dealers on January 1, 1910; result published in February Crop Reporter.

Causes and extent of deviation from normal production of various crops; results not yet published.

Monthly marketings by farmers of wheat, corn, oats, barley, flax, and hay; results published in January Crop Reporter.

The titles of some special articles prepared for the Crop Reporter (the official monthly publication of the Bureau) were: "Total values in 1908 of crops reported quantitatively, compared with values in 1899, by States" (in August Crop Reporter); "Yield per acre, by decades, of wheat, oats, barley, and rye, in various countries" (September Crop Reporter); "Production and consumption of manufactured fertilizers" (October Crop Reporter); "Statistics of mortality among farmers" (November Crop Reporter); "Per capita production of farm products, by decades" (November Crop Reporter); "Wheat prices in England in six centuries, averages by decades"

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(November Crop Reporter); "Meaning of normal in estimates of crop condition" (December Crop Reporter); "World's supply of live stock" (February Crop Reporter); "Percentages of total land area in various crops in different decades by States, and for given years by various foreign countries" (April Crop Reporter); "Total value in 1909 of crops reported quantitatively, compared with values in 1908 and 1899, by States" (May Crop Reporter).

During the year investigations in regard to acreage and production of tobacco have progressed so favorably that the Bureau is now making estimates annually of the total acreage and production of tobacco by types.

A new feature inaugurated during the year has been the publication in the Crop Reporter of charts which show graphically the relative condition of crops in the different States of the United States.

It is a gratifying fact that during the entire year there has been practically no adverse criticism or comment upon our crop estimates; on the other hand, much praise has been given, and the disposition of the public at large to give our work credence has manifestly increased to a great extent. It is notable that among those who most severely criticised the methods and results of the Bureau in past years, many have, during the year 1910, given praise and indorsement.

PLANS FOR THE YEAR ENDING JUNE 30, 1911.

During the current year ending June 30, 1911, certain improvements in plans and methods are contemplated which, it is believed, will add materially to the value of our monthly crop estimates. Among the more important may be mentioned an intended increase in the number of crops for which quantitative estimates are made. As many additional crops, now classed as "minor crops," but which are of great and growing importance, as our means and facilities will permit, will be added to the existing list of leading crops regarding which annual estimates of acreage and yield are published. The particular crops to be thus dealt with will be determined as soon as the results of the federal census, now in process of compilation, are available.

Another feature is contemplated, namely, quantitative interpretations of crop-condition estimates of important crops, made by the Crop Reporting Board, from month to month, during the growing season; that is, the figures representing the condition of each growing crop dealt with will be promulgated monthly, as in the past, and in addition, the quantity or volume of the year's final production, as indicated by the condition figures, will be stated, thus enabling all interested in our reports to realize their full import and meaning.

The most important matter to be attended to in connection with the Bureau's domestic crop reports will be taken up as soon and as rapidly as the results of the census agricultural enumerations are available, which, it is believed will be by or before the month of March, 1911. The census results showing the total acreage and production of each crop in each State for the crop year 1909 will be used in adjusting the estimates of this Bureau relating thereto, so as to conform to census figures; and the acreage figures for 1910 will also be revised by applying the reported percentage of increase or decrease for each crop to the corrected figures for 1909. Thus we shall have

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new bases for our annual estimates, which will remain unchanged until the next national agricultural census is made.

Our last annual report referred to the urgent necessity for personal supervision, inspection, and instruction of state statistical agents and special field agents. With the beginning of the current fiscal year this work has been carried on in a systematic manner. Each state statistical agent and special field agent is visited by an official of the Bureau, who is thoroughly familiar with all requirements pertaining to the collection of information regarding crop acreages, conditions, and yields, and who possesses comprehensive knowledge of agricultural statistical methods; the agents' records and methods are carefully examined, and proper instructions given when necessary. These inspections have a stimulating influence upon the agents, and will certainly result in raising the standard of accuracy and efficiency of our salaried employees whose duties are performed away from Washington.

WORK OF THE DIVISION OF PRODUCTION AND DISTRIBUTION.

PRICES OF MEAT AND FARM PRODUCTS.

In the original work of the Division of Production and Distribution during the fiscal year 1909–10 the prices of beef and pork constituted a leading place and were investigated for the purpose of ascertaining the difference between the wholesale and retail prices in many cities throughout the United States. The particular quarter, or half-carcass, or whole carcass sold by the wholesaler was followed to the retailer, and the number of pounds of each description of "cut" and other subdivisions of the original piece was ascertained, together with the price per pound.

By this method the total amount of money paid by the consumer to the retailer for the entire piece was ascertained, to be compared with the wholesale cost.

In connection with this line of investigation, an examination of the change of prices of many farm products was made, covering a period beginning with the low prices of the industrial depression of 1893–1897

GRAIN TRADE OF THE GREAT LAKES.

The marketing and transportation of grain in the region of the Great Lakes was the subject of a bulletin which was sent to press at the close of the fiscal year. This report treats of the reduction in the cost of sending grain to market and the increased quantities handled during the past quarter century. Statistical tables in the bulletin cover such topics as freight rates, receipts, and shipments in domestic trade, exports and imports across the Canadian border, tonnage carried by lake and rail, facilities for navigation, and methods of marketing.

GRAIN AND LIVE-STOCK MARKETING ON THE PACIFIC COAST.

Preliminary work was done on a bulletin relating to the marketing and transportation of grain and live stock in the Pacific Coast States. The principal object of this investigation is to show the conditions

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affecting the cost of selling and delivering grain and live stock from farm to consumer, and to make note of changes which have occurred in these conditions in the past thirty years.

An article on methods and costs of marketing was prepared in this division for the Department's Yearbook for 1909. Various features in the movements of a large number of different products from farm to consumer were described, with especial reference to the part taken by middlemen.

WAGES OF FARM LABOR.

The nineteenth investigation of the wage rates paid to farm labor was begun in the autumn of 1909 and the work was well advanced toward completion at the end of the fiscal year 1909–10. All previous investigations of farm wage rates had been confined to the money rate of wages, and hence had omitted many items of supplementary wages in the form of house rent, firewood, laundry work, and other elements of real wages not incorporated in the money rates.

The scope of this investigation has also been broadened so as to include the cost of living of the farm laborer in comparison with his cost of living as a street-railway employee or in any other occupation in town or city, an important element of the real wages of the farm laborer.

This latest investigation has introduced these essential elements into the examination of the earnings of farm labor with results that establish a favorable comparison of the farm laborer with men in competing occupations with respect to real wages.

FOREIGN TRADE IN FARM AND FOREST PRODUCTS.

The foreign trade of the United States in farm and forest products is determined by the Division of Production and Distribution and by no other office in the Departmental service. The quantities and values of the domestic exports, the imports, and the reexported imports of all agricultural and forest commodities have been classified and tabulated as far back as 1851, an undertaking of several years, which was completed in the fiscal year 1909–10. The tables so made reveal the national surplus and the national foreign requirements in the products of the farm and forest during the last sixty years, and present a large amount of information of much public interest.

In continuation of the policy of providing the public with information otherwise practically inaccessible concerning the production, value, foreign trade, and consumption of principal agricultural products for this country from the earliest times, tables for rice and hops have been added to those for cotton, tobacco, and sugar for publication in the agricultural statistics of the Yearbook of this Department.

DATES OF PLANTING AND HARVESTING.

The subject of the dates of planting and harvesting crops throughout the world has received constant attention during the year. It has proved to be one of the most difficult projects ever undertaken by the Division of Production and Distribution and has required

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scientific criticism constantly, a work in which many experts in the Bureau of Plant Industry, the Weather Bureau, and the Office of Experiment Stations have cooperated with this division. This investigation has resulted in securing much original information; and many real discoveries of relations between crop planting and growth on the one hand, and climatic, altitudinal, and latitudinal conditions on the other, which are of fundamental importance to the science of agriculture, have been made. The first bulletin of this project was nearly completed at the end of the fiscal year.

BALKAN AGRICULTURE AND FOREIGN TRADE.

A bulletin on the agriculture and foreign trade in agricultural products of Bulgaria, Roumania, and Servia was included in the work of this division in the fiscal year covered by this report. This investigation treats of topics relating to landholding, agricultural population, live stock, farm implements, area and production of leading crops, especially cereals, and foreign trade in agricultural products.

WORK FOR 1911.

The work of this division is of such a character that its future, for the next year, can be indicated with little definiteness. As far as can be foreseen, during the fiscal year 1911 the work of the nineteenth investigation of the wages of farm labor will be completed and also the bulletin on the marketing methods of the Pacific coast, an examination of the cost of distributing certain farm products from producer to consumer, a tabulation of the foreign trade of the United States in farm and forest products for 1910, a large amount of work in the agricultural statistics section of the Yearbook for 1910, the completion of another bulletin in the project concerning crop dates, and as much work as possible on various bulletins that are in hand.

WORK OF THE EDITORIAL DIVISION AND LIBRARY.

The work of the division during the year consisted, in so far as it can be readily classified, of: (1) Editing all manuscript prepared in the Bureau for publication, and correcting the proof thereof; (2) compiling comprehensive statistics, for publication in the Yearbook, of the area and production of certain crops in all foreign countries for which data are obtainable; (3) the preparation of reports, for publication each month in the Crop Reporter, on the state of agriculture in foreign countries, with special reference to the extent of surface under different crops, their current condition, and the yields, when harvested, as reflected by the official publications of the respective governments; (4) the assembling of statistical and other information and the composition of text for bulletins on the world production of and trade in cocoanuts and cocoanut products and the world production and trade in coffee; (5) the compilation of statistics, from the records of the Treasury Department, relative to the domestic production of tobacco and the consumption of hops by domestic brewers; (6) answering a part of the requests received by the Bureau from other Departments, other Bureaus of this Department, statesmen, economists, statisticians, educators, commercial exchanges,

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and business men, for statistics relating to agricultural, commercial, and economic subjects; (7) translations of letters and agricultural literature from foreign languages for the use of the Bureau, and, when requested, for other branches of the Department; (8) the management and care of the Bureau's statistical library, including the revision and maintenance of a card catalogue of the agricultural statistics contained therein; (9) stenography and typewriting for the Bureau and occasionally for other Bureaus of the Department.

Seven bulletins, one circular, and twelve monthly issues of the Crop Reporter, the official organ of the Bureau, have been edited during the year. Of the bulletins six have been published, and one—"Consolidated Schools"— is in press, being, by request, published by the Office of Experiment Stations. The original preparation of all these bulletins and of the greater part of the material of the Crop Reporter has been done in other offices and divisions of this Bureau, the functions of this division in relation to them being editorial in character. The work originating in the division is described in items 2 to 9 enumerated above.

To the Yearbook summaries, by countries, of the so-called world production of corn, wheat, oats, barley, rye, and flax-seed—summaries prepared annually in this division—there has this year, for the first time, been added, as the result of painstaking and careful researches into the official publications of foreign governments, statistics, by countries, of the acreage under these cereals in the different foreign countries during each of the past five years. The great amount of labor involved in the collection of these figures and their reduction from different foreign units to American equivalents is believed to be justified by the constantly increasing demand for information relating to the comparative soil productivity, etc., of the different countries of the world. More timely information respecting the progress of agriculture in foreign countries is also collected in the division each month and a brief summary prepared for monthly publication in the Crop Reporter, this work having been first delegated to the division in April, 1910.

The collation and coordination of statistics and the preparation of text for a bulletin on coffee production has been completed; and similar work for a bulletin on the production and trade in cocoanuts and their products is nearing completion. The editing and revision of these bulletins remains to be undertaken, and will be expedited as much as other editorial work of the division will permit. In connection with the work of the first named of these bulletins a statistical statement has been prepared of the production of coffee in different countries for each of the past five years and published in the 1909 Yearbook.

Statistics relative to the sales of tobacco by growers and to the consumption of hops by brewers in the United States—the former for use in the Bureau in connection with its estimates on tobacco production, the latter for publication in the Crop Reporter—have been compiled, as is customary each year, from records in the office of the Commissioner of Internal Revenue; the data relating to hops appear annually in the November issue of the Crop Reporter.

Many requests from public organizations and private individuals for statistical data have been referred to the division during the

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year. These inquiries have related to the usual wide diversity of subjects and required quite extensive researches into domestic and foreign statistical literature for the information requested.

The management and care of the library, translating, typewriting, etc., involves labor of a more or less routine nature, and, excepting for a constantly increasing tendency, remains of the same general character from one year to another. There have been the usual accretions to the library through exchange and purchase in statistics of agriculture, especially of those relative to the area and production of crops. It is doubtless as complete as any similar collection in the world.

WORK OF THE DIVISION OF DOMESTIC CROP REPORTS.

As in the past, the most important work of the Bureau has consisted in collecting information and compiling reports regarding crop acreages, conditions, and yields, and the number and status of farm animals. The tabulation and computation of reports received from the many thousand voluntary correspondents of the Bureau devolves upon the Division of Domestic Crop Reports; and so heavy is this work, at times, that clerks from other divisions have to be drawn into requisition to aid in their prompt compilation, so that they may be ready for final preparation and promulgation at the earliest possible date after the time to which they relate, from month to month. Approximately four-fifths of the total funds of the Bureau are expended on the work of collecting and compiling information for our monthly crop reports, the importance and necessity of which are growing rapidly.

IMPORTANCE OF FREQUENT INFORMATION.

The demand for current statistical information is constant and increasing. In all lines of human endeavor and accomplishment there is never ceasing call for facts, or, in their absence, of reliable estimates which may serve as guides to those whose interests are identified with the country's and world's productive and commercial activities.

Available statistics have never been sufficient in scope and detail to meet public demands, notwithstanding that statistical science and methods have enormously improved and developed in recent years, until at present vastly more data, covering wider ranges of industry and accomplishment, are available than in the past.

In many lines the statistics given the public are compiled from carefully kept records, of which the exports and imports of the nation, or the financial transactions and status of municipalities, States, and the country at large, are examples. The decennial census statistics are based on actual enumerations; and, nearly always, whether the subject dealt with be governmental, commercial, or otherwise, the statistical data published regarding it result from combinations of accomplished facts definitely ascertained.

The necessity for information regarding agriculture, the areas, growing conditions, and yields, of leading crops throughout the

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country, can not be met by supplying previously recorded or definitely ascertained facts, except for every tenth year, when national agricultural censuses have been taken. The results shown by the decennial censuses, while of great value, historically and for purposes of comparison, are not of immediate, current use, as they can not be published until the year to which they relate has passed. The constant public demand is for immediate current information regarding agriculture, is pressing and incessant, and must be met as far as possible.

In order to supply this demand, recourse must be had to carefully made estimates based on the best obtainable information; and the collection of such information and making of such estimates is the principal work of this Bureau. Every year these estimates are made from month to month, and are published broadcast, both officially and through the public press, throughout the length and breadth of the land; they are wholly unbiased, and supply the only annual official data for all the separate States and the country as a whole regarding the subjects to which they relate. They are relied upon so generally and have become so influential in aiding in the determination of questions of supply and distribution and of price, that the utmost care is required, not only in their preparation, but also in their publication, in order that they may not wrongly affect producers or consumers, and that they may be available to all alike.

The methods by which current information is gathered and handled, and the estimates based thereon are made, have been explained in previous reports. It will be sufficient to say here that these frequently issued estimates are principally founded on the percentage system. The acreage of a given crop in any year is reported by the correspondents and agents of the Bureau in figures representing percentages of the acreage of the preceding year. The growing condition each month of each crop reported upon is indicated in percentages of a normal condition giving promise of a full crop. The production of crops for which quantitative estimates are made are based on reports indicating estimated yields per acre, which, when tabulated and combined, are applied to the acreage figures.

This brief summary conveys no adequate idea of the great detail and infinite care involved in the work, a description of which would be technical, intricate, and tedious. It requires much training and experience, and those engaged in it must be persons of ability and judgment.

The system of collecting information regarding agricultural areas, conditions, and yields, and the numbers and status of farm animals, through reports made by correspondents and agents, reflecting their best knowledge and judgment as to the subjects dealt with, is the only tangible system by which such data can be secured short of an actual census. The diversity of crops, with their ever-changing areas, the enormous extent of farm territory, and the great variety of climatic influences in the United States, require, in the work of making estimates, the greatest possible care, involving consideration of all elements affecting agriculture in the different sections of the country.

Even with the cooperation of the Bureau's well-informed, intelligent correspondents and agents, and the exercise of experienced judgment in the consolidation and consideration of their reports, the most careful quantitative estimates may not fully reflect the facts,

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because of the lapse of years between censuses upon which such estimates must be primarily based.

Heretofore, agricultural censuses have been taken once in ten years; hereafter, such censuses are required by law to be taken every five years; and the execution of the law will contribute to the greater accuracy of the Bureau's estimates by furnishing more frequent reports based on actual enumerations to which the estimated annual percentage of increase or decrease can be applied.

Though there may be farmers, as well as others, including perhaps a few large producers, handlers, and purchasers of agricultural products, who do not take personal cognizance of the official monthly crop reports of the Bureau, and do not regulate their marketings or dealings in farm surpluses or reserves with reference to prospective or probable ultimate yields of growing crops, they are, nevertheless, indirectly benefited by these reports. The market prices in centers of trade and distribution are largely governed by probabilities of production as affecting the law of supply and demand which can not be abrogated, and must, in the last analysis, establish price. Such prices are, to a great extent, regulated and controlled by dependable information regarding growing crop conditions and probable yields, and are thus measurably protected from speculative manipulation based on exaggerated reports promulgated for the sole purpose of causing unjustifiable market price fluctuations.

The producer is protected as well as the consumer, and the evil effects of manipulative speculation are largely counteracted. The seller is enabled to realize such prices as are just, and the buyer pays what the product purchased is properly worth.

CROP CONDITION REPORTS.

Though regular, systematic reports on the condition of crops during the growing season have been made for many years by the statistical branch of the Department of Agriculture, there is occasional misunderstanding and lack of appreciation of them by those who do not comprehend their character or value, which would be obviated by an understanding of their nature, meaning, and use.

The status—that is, the general condition as to healthfulness and prospective yield—of growing crops, from seed time to harvest, has always been of vital interest and importance. Before systematic periodical reports were issued by the Government for the whole country, crop conditions were, and always had been, the subject of constant discussion and estimates regarding the probabilities of bountiful, average, or meager yields. But formerly such estimates were indefinite and intangible, were expressed in words as variable in meaning as the personalities of those using them, and incapable of translation into any form of statement capable of clear interpretation or intelligent comparison.

For example, an agricultural observer would describe a growing crop as "doing fairly well;" another would say, "corn is in need of rain;" another, "corn prospects are fair;" yet another, "corn is growing rapidly, and with good weather will yield handsomely," and so on. Such reports as these were wholly incapable of reduction to any definite, understandable statement. It was necessary to read

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the entire mass of them, and to gather an impression upon which to base a formulated statement of their meaning, which, in itself, would be more or less vague and indefinite. Whether such reports would indicate a full, normal crop, or some percentage of a full crop, could not be decided by any one. The method possessed but little value.

Under the plan of reporting crop conditions now pursued, which has been followed since 1871, the statements of reporters are expressed in figures instead of words, which indicate the percentage of full yields expected under existing conditions, in defined geographical areas. The reports are capable of tabulation and mathematical computation, and of such interpretation as to afford definite, comparable information. This method is admittedly the best, in fact, the only one by which growing crop conditions can be intelligently shown; and when the individual reports of large numbers of well-informed persons are properly rendered their consolidation can not fail to indicate existing prospects with approximate accuracy.

It should be said, however, that there can be no such infallible judgment, no such exact knowledge of the promise of present conditions, as to enable any one, no matter how intelligent and well informed, to indicate by figures or in any other manner precisely what relation an existing crop condition bears to an ultimate harvest. The observer can only make an estimate, based on his best knowledge and judgment, and render his report accordingly. If after a careful survey of the situation, he is of opinion that a normal crop is promised, he will report the condition as 100; or, if he thinks that only three-fourths of a crop can be expected, he will report "75." His reports are estimates, and, from their very nature, can not more than approximate the facts; on the other hand, when large numbers of such reports are combined, the resulting figures must closely represent actual conditions.

It should not be inferred that the indicated condition of any crop at any time during the growing season will certainly foretell the ultimate production. Many contingencies may, and frequently do, arise before and up to the time of harvest, affecting the final yield either adversely or beneficially, and it would therefore be unwise, because probably misleading, to base an unchangeable estimate of production upon any reported growing condition; such condition is subject to frequent change, is almost constantly deteriorating or improving, and any prognostication of the final harvest returns based thereon would fail of verification unless the condition estimates were exactly correct and no change in conditions occurred after they had been made.

The value of condition reports consists in the closely accurate representations they afford of growing crop prospects at given times before harvest, expressed in such manner as to convey definite meanings capable of being readily understood, and of enabling comparisons to be made with conditions, similarly expressed, at corresponding periods in preceding years. Such reports supply the constant and ever-increasing demand for tangible, intelligible information regarding the subject to which they relate, crop conditions during growing seasons being of universal interest and concern. The chart on page 19, showing the condition of corn on October 1 in the past twenty

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years, expressed in percentages of a normal condition, and the final yield, as estimated in December of each year, expressed in bushels per acre, demonstrates how closely the condition reports forecast the final results of harvests.

ADDITIONAL SPECIAL FIELD AGENTS NEEDED.

It is the constant aim and earnest endeavor of this Bureau to supply the public with unbiased crop estimates which shall be as approximately accurate as is possible with available means and sources of information.

Experience has shown that for the past few years, during which a small corps of skilled special field agents, devoting their entire time and attention to our work, has been employed, the Bureau's estimates have been more generally accepted as correctly indicating conditions and probable yields than formerly, and whenever provable by subsequently ascertained facts they have been shown to have been sufficiently close to form bases upon which producers and consumers alike have been justified in relying.

The scope and accuracy of these estimates can be still further enlarged if means can be supplied to increase the number of special field agents. The territory now covered by each of the small present force, consisting of only seventeen men, is entirely too large for any one man to canvass and report upon fully every month.

A small addition of $10,000 to our appropriation would enable the employment of three special field agents, making twenty in all, with a corresponding reduction in size of territory in important districts, and not only provide for their necessary traveling expenses but also permit the promotion of a few agents whose present salaries are not commensurate with their faithfulness, zeal, and efficiency, whose strenuous labors deserve recognition and encouragement.

PRODUCTION AND POPULATION.

HISTORICAL PROCEDURE.

Frequent assertions that the fertility of the soils is washing into the streams and that the productivity of cultivated land is diminishing are misleading the public into the belief that the agriculture of this country is decadent and that there is life in the old formula that population must tend to increase at a greater rate than subsistence.

The situation can not be understood until it is examined historically. This is a country in which millions upon millions of acres of fresh land have been coming into production faster than the domestic consumption has required, and at times beyond the takings of importing foreign countries. As eminent a man as Gen. Francis A. Walker expressed the belief that under such circumstances farmers on the fresher soil were economically justified in robbing the land.

All of the historical phases of agriculture now exist in this country. First, the "soil robber;" next the diminishing production per acre on "inexhaustible land," which surprises the farmer; next the agricultural scientist, who points the way to a better agriculture and larger production per acre, with poor responses from the farmers.

In the course of time, especially when the next and perhaps the third generation takes the farm, important advances are made, at

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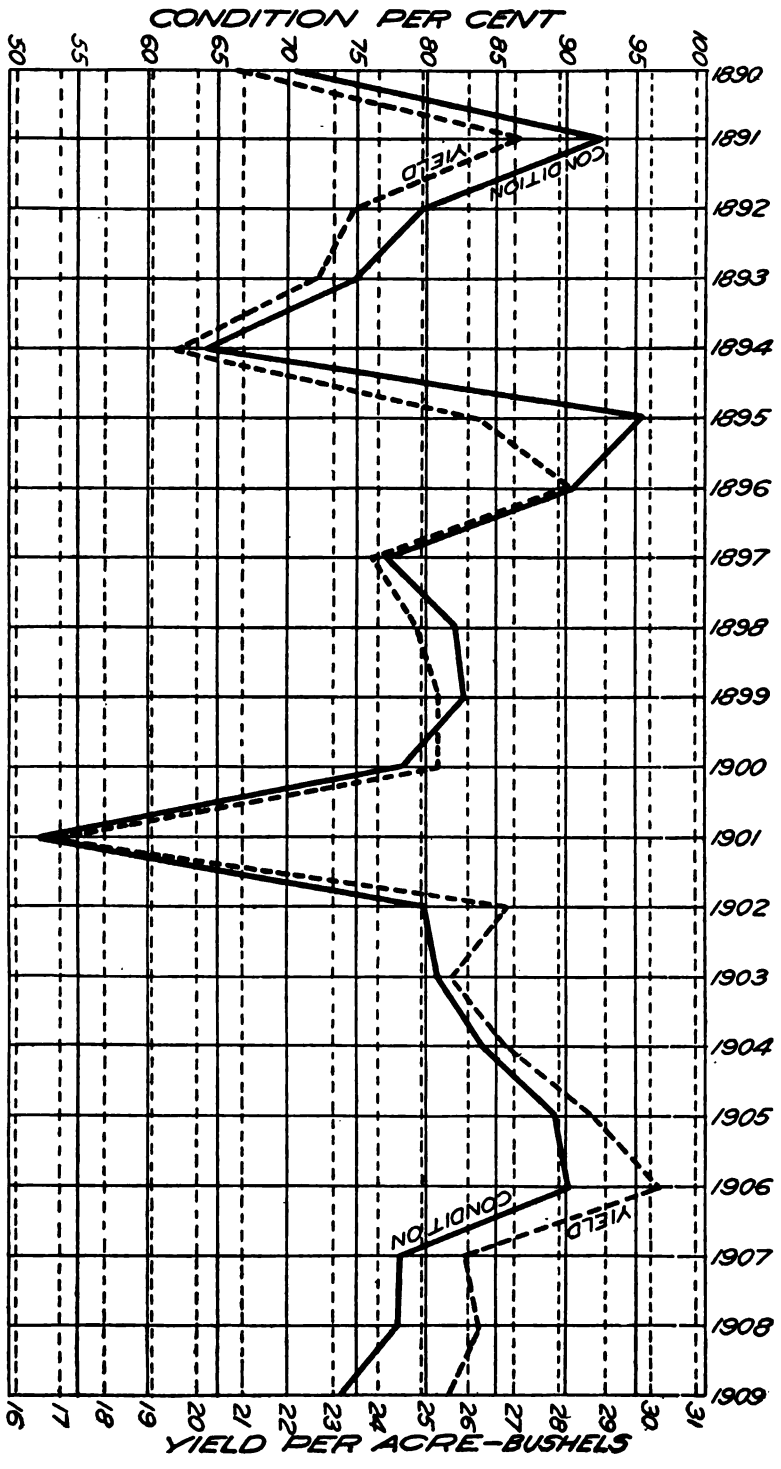

Solid line in chart represents the condition of the corn crop in the United States on October 1, yearly, 1890-1909, inclusive. Dotted line represents the average yield per acre, as finally estimated in December.

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first irregularly and mostly on farms of the leading class and subsequently with increasing diffusion and accelerated speed.

For many years there have been fresh lands with rather high but stationary production, older lands with declining production, old lands beginning to improve, and some lands well advanced in improvement. As the proportions of these classes of lands have varied in relation to the entire cultivated area of each crop the national average production per acre has varied.

In the meantime the competition of new land consuming some of its capital in the production of crops has retarded, if not prevented, the improvement of old land needing conservation and a gain in fertility. The improvement of the older land is not an academic question of conservation of national resources, but it is to be worked out in the endeavors of farmers to get a living, and a better one, an end that can not be attained by a sudden creditable production per acre large enough in the aggregate to be overproduction, with unprofitable if not losing prices for the farmer.

PRODUCTION PER ACRE FOR MANY YEARS.

It is worth while to ascertain the results of the complex factors that have governed the agricultural production of this country during the last forty-three years, as the records of this Bureau permit. The answer is to be found in mean production per acre in successive groups of years.

From the ten-year period of 1866–1875 to that of 1876–1885 the production of corn per acre in the United States declined 2.3 per cent, and the only States in which there was a gain were Maine, Rhode Island, Delaware, Maryland, Nebraska, and California. From 1876–1885 to 1886–1895 the list of gaining States was increased by Vermont, Massachusetts, Connecticut, New York, South Carolina, Georgia, Florida, Illinois, Tennessee, Alabama, Mississippi, New Mexico, and Idaho, while Delaware, Maryland, and Nebraska were transferred from a gaining to a losing production. The decline of production per acre for the United States was 8.2 per cent.

Advancing another decade to 1896–1905, corn production per acre gained in 30 of the 46 States and Territories, and the United States average increased 7.7 per cent, in spite of the disastrous season of 1901.

The mean production per acre during the four years 1906–1909 increased 7.1 per cent over the mean of the preceding ten years.

Wheat has been disposed to increase in production per acre more generally than corn. From 1866–1875 to 1876–1885 the mean per acre increased in Maine, New York, Pennsylvania, Delaware, Maryland, West Virginia, South Carolina, Ohio, Indiana, Illinois, Michigan, and Kentucky, and the increase for the United States was 3.4 per cent.

From 1876–1885 to 1886–1895 the mean production per acre increased in 24 out of 41 States and Territories; New York, Michigan, Nebraska, Kansas, Oregon, and California were not included in the gaining States. The gain for the United States was 3.3 per cent.

In the next decade, 1896–1905, the mean production of wheat per acre gained in 35 out of 44 States and Territories, the conspicuous omitted States being Ohio, Indiana, Illinois, Michigan, Minnesota,

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Missouri, North Dakota, and California. For the United States the gain was 6.3 per cent for the mean of the ten years 1896–1905 over that of the previous ten years; for the mean of the four years 1906–1909 the gain over that of the previous ten years was 9.6 per cent.

Tobacco production in the United States increased 3.4 per cent from 1866–1875 to 1876–1885, Virginia and North Carolina being conspicuous States that did not participate. In the following decade there was a decline of 2 per cent in production per acre in the United States, followed by an increase of 5.2 per cent in the decade 1896–1905, the only conspicuous States that suffered a decline being Connecticut and New York. The mean production per acre of the four years 1906–1909 is an increase of 9.7 per cent over that of the preceding ten years.

During two of the four years, 1906–1909, the cotton production per acre was light because of adverse weather and the boll weevil, but in spite of that the mean of these four years is 0.3 per cent above that of the ten years 1896–1905, which was the decade that exceeded each of the three preceding decades in production per acre. The only cotton States which in this decade did not improve over the mean of 1886–1895 were Florida, Texas, and Arkansas; for the United States the gain was 3.8 per cent.

Potato production per acre in the United States declined sharply from 1866–1875 to 1886–1895, after which there was a marked increase during 1896–1905, followed by another increase during 1906–1909 to a higher average production per acre than is disclosed by any ten-year mean as far back as the records extend, to 1866. Every potato State gained in production per acre in 1896–1905 over the previous decade except North Carolina, Georgia, Tennessee, Alabama, Louisiana, Texas, Arkansas, and New Mexico. The gain for the United States was 15.3 per cent and the mean of the following four years is 15.5 per cent higher than that of the preceding ten years.

Hay stood higher in mean production per acre in 1896–1905 than in any of the preceding three decades. The gain over the decade 1886–1895 was 22 per cent, to which all States and Territories contributed except Florida. A similar sort of statement applies to oats, the percentage of increase of production per acre for the mean of 1896–1905 being 15.6 per cent over that of the preceding ten years, the States that did not have an increase being few—Missouri, Kansas, and Oregon.

Again, for barley and rye a similar history appears. For barley the mean production per acre in 1896–1905 increased 11.1 per cent over the mean of the preceding ten years, the only States that had a decline being New Hampshire, Missouri, and Connecticut. For rye the percentage of increase was 21.3, and the only State that did not participate was California. Both barley and rye gained in mean production per acre in the four years 1906–1909.

After thirty years of decadence, buckwheat all but regained its mean production per acre in 1896–1905; and afterwards gained 6.6 per cent on the previous decade in 1906–1909, thereby reaching the highest production per acre in the records of this Bureau.

The general trend of the mean production per acre was a declining one during the two decades 1876–1885 and 1886–1895 for corn, oats, rye, and potatoes; it declined in the first decade and slightly increased in the second in the case of barley, buckwheat, and cotton; it

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increased during the first decade and diminished during the second in the case of hay and tobacco; in the case of wheat there was an increase of production per acre throughout the two decades, the respective percentages of increase being 3.4 and 3.3.

A marked change in the production per acre of all crops appeared in the decade 1896–1905 in comparison with the mean of the preceding ten years. The production per acre of corn increased 7.7 per cent; of wheat, 6.3 per cent; of oats, 15.6 per cent; of barley, 11.1 per cent; of rye, 21.3 per cent; of buckwheat, 23.1 per cent; of hay, 22 per cent; of potatoes, 15.3 per cent; of cotton, 3.8 per cent; and of tobacco, 5.2 per cent. The weather of the four years 1906–1909 was not as favorable for crop production as it was in the preceding ten years, so that the production of oats per acre declined, that of hay remained stationary, and that of cotton and barley barely increased.

In the case of other crops the mean production per acre continued to show large increases, the mean of these four years over that of the preceding ten years being an increase of 7.1 per cent for corn, 9.6 per cent for wheat, 6.5 per cent for rye, 6.6 per cent for buckwheat, 15.5 per cent for potatoes, and 9.7 per cent for tobacco.

Summarizing the annual estimated yield per acre, the chart on opposite page is presented, which is self-explanatory.

The following tables exhibit the trend of production per acre for the crops named from the decade 1866–1875 to 1909, or the mean of the last four years, 1906–1909, as the case may be. The figures amply establish the fact that the agriculture of the United States, after passing through a phase of decadence incident to the exploitation of new land, has obtained a secure footing in the contrary direction toward improvement.

Comparative production per acre of specified crops in the United States.

[100=mean for 1896–1905.]

Period and year.	Corn.	Wheat.	Oats.	Barley.	Rye.	Buckwheat.	Hay.	Potatoes.	Cotton.	Tobacco.
1866–1875	103.6	88.1	94.9	91.2	88.3	101.1	84.7	110.1	96.6	93.8
1876–1885	101.2	91.1	93.2	89.2	86.4	80.7	86.8	96.2	93.9	97.0
1886–1895	92.9	94.1	86.5	90.0	82.5	81.2	81.9	86.7	96.3	95.0
1896–1905	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1906	120.2	114.8	105.4	112.7	108.4	102.8	93.8	121.1	110.9	112.9
1907	102.8	103.7	80.1	94.8	106.5	98.9	100.7	113.0	97.6	112.0
1908	104.0	103.7	84.5	100.0	106.5	109.4	105.6	101.5	106.7	108.0
1909	101.2	117.0	102.4	96.8	104.5	115.5	98.6	126.5	85.9	105.9

Percentage of increase (+) or decrease (−) of yield per acre in the United States.

Crops.	1866–1875 to 1876–1885.	1876–1885 to 1886–1895.	1886–1895 to 1896–1905.	1896–1905 to 1906–1909.
Corn	− 2.3	−8.2	+ 7.7	+ 7.1
Wheat	+ 3.4	+3.3	+ 6.3	+ 9.6
Oats	− 1.8	−7.2	+15.6	− 6.8
Barley	− 2.2	+0.9	+11.1	+ 1.2
Rye	− 2.2	−4.5	+21.3	+ 6.5
Buckwheat	−20.2	+0.7	+23.1	+ 6.6
Hay	+ 2.5	−5.6	+22.0	0.0
Potatoes	−12.6	−9.9	+15.3	+15.5
Cotton	− 2.8	+2.6	+ 3.8	+ 0.3
Tobacco	+ 3.4	−2.0	+ 5.2	+ 9.7

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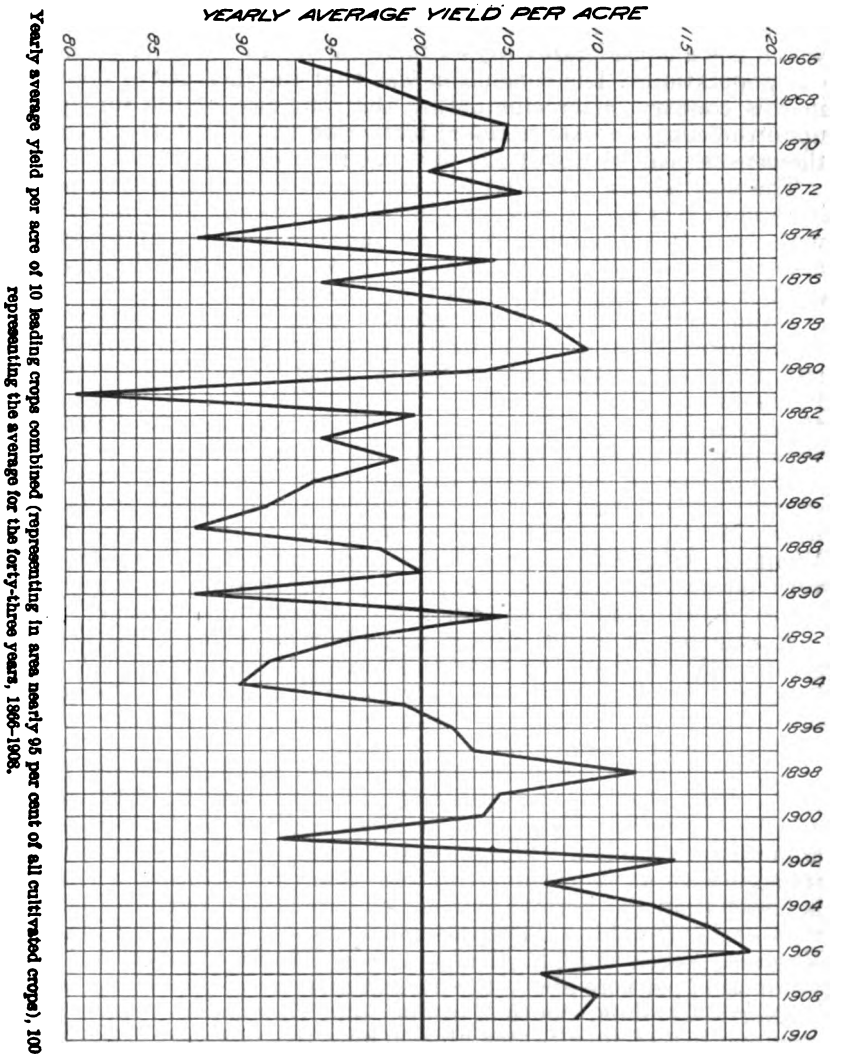
PRODUCTION COMPARED WITH NORMAL INCREASE OF POPULATION.

The statistical test that the farmers of this country have met in the foregoing examination of production per acre is not as severe as the one which in varying degrees and in varying numbers of States they are prepared to meet in a comparison of production per acre with population. There is a prevalent misunderstanding with regard to the nature of the increase of population in this country. It seems to



Yearly average yield per acre of 10 leading crops combined (representing in area nearly 95 per cent of all cultivated crops), 100 representing the average for the forty-three years, 1866-1908.

be assumed that the net immigration is to continue for a century and over at the rate of one-half to three-fourths of a million people annually. How quickly immigration can be reduced to zero was shown by the industrial depression of 1908. No one who would take a far sight into the future would reckon upon an indefinite continuance of a considerable immigration.

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Another prevalent oversight in a consideration of this subject concerns the birth rate. It seems not to be generally known that the birth rate of this country, as of all the countries of western and central Europe, is a diminishing one; so that while the increase of population must be admitted to the reckoning a diminishing rate of increase must be recognized. A former chief clerk of the Bureau of the Census, Mr. William S. Rossiter, made an examination of the population statistics of the census of 1900 and the two preceding ones for the purpose of determining the present increase of population of the older race stocks. In other words, he eliminated the foreign-born element, which has a considerably higher birth rate than the older elements of our population. The conclusion was that the increase of population in this country, after eliminating the influence of the foreign-born upon the conglomerate national birth rate, was about 1¼ per cent for the census year, or about 12½ per cent for a decade.

The way is now prepared for a comparison of production per acre in recent years with the normal increase of population; that is to say, with the increase unaffected by immigration and the high birth rate of the immigrants. This is the form of the problem as it will present itself more and more closely as the years elapse.

From 1886–1895 to 1896–1905 the mean production per acre of wheat increased in a greater degree than the normal increase of population in four New England States, New York, New Jersey, and Pennsylvania, eleven Southern States, Wisconsin, Nebraska, seven Mountain States and Territories, and Washington. Two States are very near inclusion in this list—Wyoming and Oregon.

In the case of corn production, increased production per acre has exceeded the normal increase of population in Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Ohio, Indiana, Illinois, Michigan, Wisconsin, South Dakota, and three Mountain States, and very nearly the required increased production was made by New Jersey, North Dakota, Nebraska, New Mexico, and Arizona.

A long list of States gained in production of oats per acre in a greater degree than the normal increase in population. They are found in New England and along the Atlantic coast to Georgia; in important States of the Ohio Valley, north and south; in the Mountain States; and in Washington.

With regard to barley twenty-one States and Territories are found in the similar list; for rye the list of States numbers 30, buckwheat 19, and Vermont, New York, and Delaware are near the requirement for admission to the list. Wisconsin is the only State that has produced tobacco with an increase during the time under consideration which is larger than the normal increase of population, but the increase is very nearly equal to this population increase in the case of Maryland, Virginia, North Carolina, Indiana, and Illinois. Increase of cotton production per acre above the normal increase of population is found in North Carolina, South Carolina, and Oklahoma, with a supplementary list of four States almost able to enter the list—Virginia, Tennessee, Georgia, and Louisiana.

The list of States that produced potatoes with an increase per acre above the normal increase of population contains many of the States in the potato belt, and the number is 24, with 4 States almost eligible for admission.

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The largest list of States in the consideration of the various crops in which production per acre during the period under consideration exceeded normal increase of population is found in the case of hay; 35 States are in this list with 5 more States having increases nearly sufficient for their entry, so that the hay crop of nearly the entire United States has increased in production per acre faster than the normal rate of increase of the population.

COMPARISON WITH ACTUAL INCREASE OF POPULATION.

A still more severe test than the foregoing may be placed upon the increased production per acre of the crops under consideration, and in this test the increase may be compared with the actual increase of population which, as before explained, is greater than the normal increase. Corn production per acre increased from 1886–1895 to 1896–1905 at a rate which quite or very nearly equaled the actual increase of population in Delaware, Maryland, Virginia, West Virginia, Ohio, Illinois, Wisconsin, Michigan, South Dakota, and Utah. The list for wheat contains 22 States and Territories distributed in all parts of the United States. In the list for oats are 16 States; for barley, 15 States; for rye, 21 States; for buckwheat, 18 States; for cotton, only 1 State, Oklahoma, containing new land; for tobacco only Wisconsin; for potatoes, 15 States, all in the potato belt; and for hay, 25 States and Territories.

A POTENTIAL FUTURE.

The foregoing presentation of the information that is possessed concerning the trend of agricultural production in this country in comparison with population makes it plain that in spite of the fact that the United States is now passing through some of the early and middle phases of agricultural land exploitation, it nevertheless appears that the final stage of better agriculture and increased production per acre has been reached in many States for a varying number of crops, and that production per acre is not only beginning to exceed the normal increase of population, but really to exceed the actual increase.

The ability of the soil and of the agricultural arts and sciences to produce crops at a rate of increase greater than either the normal rate of increase of population, or the normal as temporarily influenced by immigration, has been demonstrated times innumerable by the Department of Agriculture, by the experiment stations, and by intelligent farmers all over the country. The potentiality of agricultural production as a national achievement sufficient for growth of population has been so numerously and so thoroughly demonstrated as to be now beyond intelligent question. The Farmers' Cooperative Demonstration Work, now carried on in 12 cotton States, employs 375 traveling agents and has many thousands of demonstrating farms. It is proving by results on thousands of farms that preparation of the soil so as to make the best seed bed adds 100 per cent to the average crop on similar lands with an average preparation in the old way; that the planting of the best seed makes a gain of 50 per cent; and that shallow, frequent cultivation produces an increase of another 50 per cent, making a total gain of 200 per cent, or a crop three times the

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average crop produced on those farms where the plans and methods of the demonstration work have been adopted.

THE INCREASED COST OF LIVING.

A dominant feature from a statistical view point of the past year, as well as now, has been the persistent agitation regarding and discussion of the increased cost of living.

The prices of food products, wearing apparel, and other necessaries have been advancing in recent years to an extent that has caused widespread interest and vital concern to all classes except those whose incomes are sufficiently large to render them indifferent to increased costs, or to those whose earnings and consequent buying power have increased in equal or greater ratio than have the prices of commodities they are compelled to purchase.

The general advance in prices has been greater than the increase in earnings of the average wage-earner in cities and towns or those employed in mining, manufacturing, or transportation, whose incomes, in many instances, have been stationary or nearly so. Thousands of these classes have been feeling more and more the pressure of advancing prices, and their plaints have been voiced frequently and insistently by newspapers, magazines, and legislators.

But the advance in prices has not affected similarly all classes of those who work for their livelihood, and the question as to whether such advance has or has not become burdensome depends for its solution in any case on the ascertainment of facts regarding the relative earnings and purchasing power of consumers at this time as compared with a time when necessary commodities of nearly every kind commanded lower prices than at present.

There is no question as to the conditions prevailing in cities and towns; in the country, however, they have been and are far different.

Quietly the farmer has been rising from the depths into which he was cast by the ruinously low prices in the early nineties until now he has reached a plane where he receives a well-deserved recompense for his labors. Probably never before has the average farmer been in better condition than in recent years. Farmers are rapidly acquiring the modern conveniences formerly possessed only by those living in cities, such as furnace-heated houses, water and bath facilities, free mail delivery, telephones, etc., and, with good crops commanding remunerative prices, he is becoming more and more able to secure such conveniences and to indulge in many luxuries enjoyed previously only by the prosperous in urban communities.

Within the past ten years the purchasing power of the farmer has increased more than 50 per cent. Such conditions are having and will continue to have more force in keeping the rising generation of farmers' children upon the farm than volumes upon volumes of printed advice to stay there. When there was much hardship and no profit in farming, such advice was useless; now farm life is becoming profitable and more attractive, and such advice is becoming unnecessary.

With a view to ascertaining definitely the effect of the higher prices of nearly every necessary of life on the greatest of all classes of Americans engaged in the greatest of all American occupations, the Bureau of Statistics has recently made a special inquiry regarding the average retail prices of about eighty-five staple commodities

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purchased by farmers throughout the United States in 1899 and 1909. The required information was supplied by many retail merchants throughout the country, the average prices at which the goods were sold during each of the two years beginning and ending the decade being for goods of the same grade and description in each instance.

The data thus secured, used in connection with comparative yields per acre of ten leading crops, the prices received for them by farmers, and their consequent average value per acre in each of the years mentioned, clearly show that the American farmer has suffered no loss or curtailment of purchasing power. On the contrary, the farmers' ability to buy has increased much more than the prices of the things he has bought.

The three following tabular presentations make this fact very clear. They show, first, the average farm value per acre in 1899 and 1909 of ten leading crops, separately, and their combined average value per acre; second, the average retail prices at which eighty-five staple manufactured products were sold to farmers by merchants throughout the United States in 1899 and 1909; and, third, the buying power possessed by three of the crops specified in the first table, namely, corn, wheat, and cotton, as applied to each of the commodities named in the second table, with the average combined buying power per acre of all ten of said crops. The tables are self-explanatory.

Acreage, yield, farm price, and farm value per acre of specified crops in 1899 and 1909.

[The acreages and yields for 1899 are as reported by the Bureau of the Census; those for 1909 are as estimated by the Bureau of Statistics, U. S. Department of Agriculture. The farm prices for both years are as reported by the Bureau of Statistics.]

Crop.	Acres (000 omitted).		Total yield (000 omitted).		Yield per acre.	
	1899.	1909.	1899.	1909.	1899.	1909.
Corn.....bushels..	94,914	108,771	2,666,324	2,772,376	28.1	25.5
Wheat[a].....do....	52,589	46,723	658,534	737,189	12.5	15.8
Oats.....do....	29,540	33,204	943,389	1,007,353	31.9	30.3
Barley.....do....	4,470	7,011	119,635	170,284	26.8	24.3
Rye.....do....	2,054	2,006	25,569	32,239	12.4	16.1
Buckwheat.....do....	807	834	11,234	17,438	13.9	20.9
Potatoes.....do....	2,939	3,525	273,318	376,537	93.0	106.8
Hay.....tons..	61,691	45,744	84,011	64,938	1.4	1.42
Tobacco.....pounds..	1,101	1,180	868,113	949,357	788.2	804.3
Cotton.....do....	24,275	30,938	4,467,097	4,783,220	184.0	154.6

Crop.	Farm price per unit December 1—		Farm value per acre December 1—		Per cent increase in value, 1909 over 1899.
	1899.	1909.	1899.	1909.	
	Cents.	*Cents.*	*Dollars.*	*Dollars.*	
Corn.....bushels..	30.3	59.6	8.51	15.20	78.6
Wheat[a].....do....	58.4	99.0	7.30	15.64	114.0
Oats.....do....	24.9	40.5	7.94	12.27	54.5
Barley.....do....	40.3	55.2	10.80	13.41	24.2
Rye.....do....	51.0	73.9	6.32	11.90	88.3
Buckwheat.....do....	55.7	69.9	7.74	14.61	88.8
Potatoes.....do....	39.0	54.9	36.27	58.63	61.7
Hay.....tons..	$7.27	$10.62	10.18	15.08	48.1
Tobacco.....pounds..	6.6	10.1	52.02	81.23	56.2
Cotton.....do....	[b]7.24	13.9	[b]13.32	[b]22.06	65.6
Average.....	.....	.....	9.51	16.42	72.7

[a] Spring and winter wheat combined. [b] Average value for season.

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Within the past year this Bureau sent the following letter of inquiry to a large number of retail dealers doing business with farmers:

It is the desire of this Bureau to obtain comparative prices of various articles of general use, in the years 1899 and 1909, in order to ascertain how much such prices have increased or decreased in various parts of the United States. I shall appreciate it very much if you will quote the prices which prevailed in the two years mentioned for such articles as you can conveniently. Prices for the two years should be for the same grades of articles, so that they may be properly compared.—(Signed by the Chief of the Bureau of Statistics.)

This letter was accompanied by a list of about eighty-five articles of general use by farmers.

Replies to this inquiry were tabulated and averaged, with the following result:

Comparative prices of articles purchased by farmers in 1909 and 1899.

Article.	1909.	1899.	Percentage, 1909 to 1899.
Coal oil, gallon ..... cents..	14.2	15.1	93.9
Coffee, pound ..... do....	18.9	17.2	109.8
Flour, barrel ..... dollars..	6.3	4.76	132.4
Lard, pound ..... cents..	15.7	10.3	151.5
Matches, box ..... do....	5.0	5.0	100.0
Salt, barrel ..... dollars..	1.6	1.39	114.9
Soap, cake ..... cents..	4.19	3.99	105.0
Starch, pound ..... do....	7.4	7.2	102.8
Sugar, pound ..... do....	5.73	5.27	108.7
Tobacco, plug, pound ..... do....	45.0	41.7	108.0
Brooms, each ..... do....	44.0	28.6	153.8
Dish pans, each ..... do....	31.2	28.7	108.7
Dinner plates, set ..... do....	71 5	67.8	105.4
Fruit jars, dozen ..... do....	78.4	72.8	107.7
Kitchen chairs, each ..... do....	81.6	72.3	112.9
Lamps, each ..... do....	48.2	46.0	104.8
Stoves, each ..... dollars..	21.8	19.7	110.7
Tin pails, each ..... cents..	24.4	23.0	106.1
Wooden buckets, each ..... do....	27.2	22.6	120.4
Wooden washtubs, each ..... do....	82.6	70.4	117.3
Gloves, pair ..... do....	84.4	71.6	117.9
Hats, each ..... dollars..	1.88	1.67	112.6
Jumpers, each ..... cents..	74.0	61.4	120.5
Overalls, each ..... do....	80.6	65.6	122.9
Raincoats, each ..... dollars..	3.97	3.32	119.6
Rubber boots, pair ..... do....	4.18	3.24	129.0
Shirts, flannel, each ..... do....	1.44	1.21	119.0
Shoes, brogan, pair ..... do....	1.94	1.48	131.1
Calico, yard ..... cents..	6.6	5.2	126.9
Muslin, yard ..... do....	9.0	7.2	125.0
Sheeting, yard ..... do....	18.2	14.3	127.3
Axes, each ..... do....	89.8	82.6	108.7
Barb wire, 100 pounds ..... dollars..	3.16	2.96	106.8
Dungforks, each ..... cents..	69.0	62.0	111.3
Hatchets, each ..... do....	59.0	53.8	109.7
Lanterns, each ..... do....	77.0	72.4	106.4
Nails, 100 pounds ..... dollars..	3.15	2.98	106.7
Pitchforks, each ..... cents..	56.8	50.8	111.8
Pincers, each ..... do....	44.2	41.6	106.2
Saws, buck, each ..... do....	76.8	71.0	108.2
Screw hooks, box ..... do....	33.2	31.6	105.1
Screw eyes, box ..... do....	32.4	31.0	104.5
Shotguns, each ..... dollars..	11.3	12.3	91.9
Steel traps, each ..... cents..	27.6	24.6	112.2
Shovels, each ..... do....	76.8	70.0	109.7
Staples, 100 pounds ..... dollars..	3.81	3.51	108.5
Steel wire, 100 pounds ..... do....	3.76	3.57	105.3
Wire fence, rod ..... cents..	36.0	34.1	105.6
Axle grease, box ..... do....	10.0	9.6	104.2
Buggies, each ..... dollars..	76.8	70.3	109.2
Buggy whips, each ..... cents..	42.1	39.8	105.8
Corn cutters, each ..... do....	27.3	25.0	109.2
Churns, each ..... dollars..	1.04	.92	112.6
Cream separators, each ..... do....	59.19	64.95	91.1
Grindstones, each ..... do....	3.78	3.44	109.9
Halters, each ..... cents..	70.6	63.0	112.1
Harness, single, set ..... dollars..	18.21	15.21	119.7
Horse blankets, each ..... do....	1.77	1.58	112.0
Hoes, each ..... cents..	44.8	38.8	115.5

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Comparative prices of articles purchased by farmers in 1909 and 1899—Continued.

Article.	1909.	1899.	Percentage, 1909 to 1899.
Harrows, ordinary, each ..... dollars..	10.49	9.27	113.2
Manure spreaders, each ..... do....	103.33	100.55	102.7
Mowers, each ..... do....	47.23	46.01	102.7
Picks, each ..... cents..	70.7	66.0	107.1
Plows, turning, each ..... dollars..	11.45	10.76	106.4
Scythes, each ..... cents..	86.0	74.1	116.1
Saddles, each ..... dollars..	16.56	14.52	114.0
Tedders, each ..... do....	29.4	27.4	107.0
Wagons, single, each ..... do....	47.45	44.47	106.7
Wagons, double, each ..... do....	68.83	60.72	113.4
Carbolic acid, crude, pound ..... cents..	35.0	30.0	116.7
Copperas, pound ..... do....	10.0	10.0	100.0
Lime, barrel ..... dollars..	1.29	1.12	115.2
Paris green, pound ..... cents..	30.5	27.0	113.0
Sulphur, pound ..... do....	8.5	8.5	100.0
Witch-hazel, pint bottle ..... do....	25.0	25.0	100.0
Baskets, one-half bushel, each ..... do....	51.2	39.0	131.3
Milk cans, 10-gallon, each ..... dollars..	2.68	2.56	104.7
Milk pails, each ..... cents..	37.7	34.4	109.6
Paints, ready mixed, gallon ..... dollars..	1.62	1.29	125.6
Paint brushes, each ..... cents..	76.3	67.9	112.4
Rope, hemp, pound ..... do....	13.6	12.4	109.7
Sacks, grain, each ..... do....	18.0	14.0	128.6
Scales, small, each ..... dollars..	1.04	.96	108.3
Twine, binder, 100 pounds ..... do....	9.74	9.06	107.5
Average, all articles	.....	.....	112.1

The quantity of articles specified which could be purchased with the value of 1 acre of corn and wheat, respectively, in 1909 and 1899, was as follows:

Quantity purchasable by value of 1 acre.

Article	Corn.		Wheat.	
	1909.	1899.	1909.	1899.
Coal oil ..... gallons..	107.0	56.4	110.0	48.3
Coffee ..... pounds..	80.4	49.5	82.6	42.4
Flour ..... barrels..	2.4	1.8	2.5	1.5
Lard ..... pounds..	96.8	82.6	99.5	70.9
Matches ..... boxes..	304.0	170.2	312.4	146.0
Salt ..... barrels..	9.5	6.1	9.8	5.3
Soap ..... cakes..	362.8	213.3	372.8	183.0
Starch ..... pounds..	205.4	118.2	211.1	101.4
Sugar ..... do....	265.3	161.5	272.6	138.5
Tobacco ..... do....	33.8	20.4	34.7	17.5
Brooms	34.5	29.8	35.5	25.5
Dish pans	48.7	29.7	50.1	25.4
Dinner plates ..... sets..	21.3	12.6	21.8	10.8
Fruit jars ..... dozens..	19.4	11.7	19.9	10.0
Kitchen chairs	18.6	11.8	19.1	10.1
Lamps	31.5	18.5	32.4	15.9
Tin pails	62.3	37.0	64.0	31.7
Wooden buckets	55.9	37.7	57.4	32.3
Wooden washtubs	18.4	12.1	18.9	10.4
Gloves	18.0	11.9	18.5	10.2
Hats, felt	8.1	5.1	8.3	4.4
Jumpers	20.5	13.5	21.1	11.9
Overalls	18.9	13.0	19.4	11.1
Rain coats	3.8	2.6	3.9	2.2
Rubber boots	3.6	2.6	3.7	2.3
Shirts, flannel	10.6	7.0	10.8	6.0
Shoes, brogan ..... pairs..	7.8	5.8	8.1	4.9
Calico ..... yards..	230.3	163.7	236.7	140.4
Muslin ..... do....	168.9	118.2	173.6	101.4
Sheeting ..... do....	83.5	59.5	85.8	51.0
Axes	16.9	10.3	17.4	8.8
Barb wire ..... pounds..	481.0	287.5	494.3	246.6
Dungforks	22.0	13.7	22.6	11.8
Hatchets	25.8	15.8	26.5	13.1
Lanterns	19.7	11.8	20.3	10.9
Nails ..... pounds..	482.5	285.6	496.9	245.0

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Quantity purchasable by value of 1 acre—Continued.

Article.	Corn.		Wheat.	
	1909.	1899.	1909.	1899.
Pitchforks	26.8	16.8	27.5	14.4
Pincers	34.4	20.5	35.3	17.5
Saws, buck	19.8	12.0	20.3	10.3
Screw hooks, boxes	45.8	26.9	47.0	23.1
Screw eyes, do	46.9	27.5	48.2	23.5
Steel traps	55.1	34.6	56.6	29.7
Shovels	19.8	12.2	20.3	10.4
Staples, pounds	399.0	242.5	410.0	208.0
Steel wire, do	404.3	238.3	415.4	204.5
Wire fence, rods	42.2	25.0	43.4	21.4
Axle grease, boxes	152.0	88.6	156.2	76.0
Buggy whips	36.1	21.4	37.1	18.3
Corn cutters	55.7	34.0	57.2	29.2
Churns	14.6	9.2	15.0	7.9
Halters	21.5	13.5	22.1	11.6
Horse blankets	8.6	5.4	8.8	4.6
Hoes	33.9	21.9	34.9	18.8
Picks	21.5	12.9	22.1	11.1
Sprayers	16.1	9.4	16.5	8.0
Scythes	17.7	11.5	18.2	9.9
Carbolic acid, pounds	43.4	28.4	44.6	24.3
Copperas, do	152.0	85.1	156.2	73.0
Lime, barrels	11.8	7.6	12.1	6.5
Paris green, pounds	49.8	31.5	51.2	27.0
Sulphur, do	178.8	100.1	183.8	85.9
Witch-hazel, pints	60.8	34.0	62.5	29.2
Baskets, one-half bushel	29.7	21.8	30.5	18.7
Milk cans, 10-gallon	5.7	3.3	5.8	2.9
Milk pails	40.3	24.7	41.4	21.2
Paints, ready mixed, gallons	9.4	6.6	9.6	5.7
Paint brushes	19.9	12.5	20.5	10.8
Rope, hemp, pounds	111.8	66.6	114.9	56.9
Sacks, grain	84.4	60.8	86.8	52.1
Scales, small	14.6	8.9	15.0	7.6
Twine, binder, pounds	156.1	93.9	160.4	80.6

The quantity of articles specified which could be purchased with the value of 1 acre of cotton and with the average value of 1 acre of all crops, in 1909 and 1899, was as follows:

Quantity purchasable from value of 1 acre.

Article.	Cotton.		Average of all crops.	
	1909.	1899.	1909.	1899.
Coal oil, gallons	155.4	88.2	115.6	63.0
Coffee, pounds	116.7	77.4	86.9	55.3
Flour, barrels	3.5	2.8	2.6	2.0
Lard, pounds	140.5	129.3	104.6	92.3
Matches, boxes	441.2	266.4	328.4	190.2
Salt, barrels	13.8	9.6	10.3	6.8
Soap, cakes	526.5	333.8	391.9	238.3
Starch, pounds	298.1	185.0	221.9	132.1
Sugar, do	385.0	252.8	286.6	180.5
Tobacco, do	49.0	31.9	36.5	22.8
Brooms	50.1	46.6	37.3	33.3
Dish pans	70.7	46.4	52.6	33.1
Dinner plates, sets	30.9	19.6	23.0	14.0
Fruit jars, dozens	28.1	18.3	20.9	13.1
Kitchen chairs	27.0	18.4	20.1	13.2
Lamps	45.8	29.0	34.1	20.7
Tin pails	90.4	57.9	67.3	41.3
Wooden buckets	81.1	58.9	60.4	42.1
Wooden washtubs	26.7	18.9	19.9	13.5
Gloves	26.1	18.6	19.5	13.3
Hats, felt	11.7	8.0	8.7	5.7
Jumpers	29.8	21.7	22.2	15.5
Overalls	27.4	20.3	20.4	14.5
Rain coats	5.6	4.0	4.1	2.9
Rubber boots	5.3	4.1	3.9	2.9

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Quantity purchasable from value of 1 acre—Continued.

Article.	Cotton.		Average of all crops.	
	1909.	1899.	1909.	1899.
Shirts, flannel	15.3	11.0	11.4	7.9
Shoes, brogan, pairs	11.4	9.0	8.5	6.4
Calico, yards	334.2	256.2	248.8	182.9
Muslin, do	245.1	185.0	182.4	132.1
Sheeting, do	121.2	93.1	90.2	66.5
Axes	24.6	16.1	18.3	11.5
Barb wire, pounds	698.1	450.0	519.6	321.3
Dungforks	32.0	21.5	23.8	15.3
Hatchets	37.4	24.8	27.8	17.7
Lanterns	28.6	18.4	21.3	13.1
Nails, pounds	700.3	447.0	521.3	319.1
Pitchforks	38.8	26.2	28.9	18.7
Pincers	49.9	32.0	37.1	22.9
Saws, buck	28.7	18.8	21.4	13.4
Screw hooks, boxes	66.4	42.2	49.5	30.1
Screw eyes, do	68.1	43.0	50.7	30.7
Steel traps	79.9	54.1	59.5	38.7
Shovels	28.7	19.0	21.4	13.6
Staples, pounds	579.0	379.4	431.0	270.9
Steel wire, do	586.7	373.1	436.7	266.4
Wire, fence, rods	61.3	39.1	45.6	27.9
Axle grease, boxes	220.6	138.8	164.2	99.1
Buggy whips	52.4	33.5	39.0	23.9
Corn cutters	80.8	53.3	60.1	38.0
Churns	21.2	14.5	15.8	10.3
Halters	31.2	21.1	23.3	15.1
Horse blankets	12.5	8.4	9.3	6.0
Hoes	49.2	34.3	36.7	24.5
Picks	31.2	20.2	23.2	14.4
Sprayers	23.3	14.7	17.3	10.5
Scythes	25.7	18.0	19.1	12.8
Carbolic acid, pounds	63.0	44.4	46.9	31.7
Copperas, do	220.6	133.2	164.2	95.1
Lime, barrels	17.1	11.9	12.7	8.5
Paris green, pounds	72.3	49.3	53.8	35.2
Sulphur, do	259.5	156.7	193.2	111.9
Witch-hazel, pints	88.2	53.3	65.7	38.0
Baskets, one-half bushel	43.1	34.2	32.1	24.4
Milk cans, 10-gallon	8.2	5.2	6.1	3.7
Milk pails	58.5	38.7	43.6	27.6
Paints, ready-mixed, gallons	13.6	10.3	10.1	7.4
Paint brushes	28.9	19.6	21.5	14.0
Rope, hemp, pounds	162.2	107.4	120.7	76.7
Sacks, grain	122.6	95.1	91.2	67.9
Scales, small	21.2	13.9	15.8	9.9
Twine, binder, pounds	226.5	147.0	168.6	105.0

The number of acres of corn, of wheat, etc., which was required to buy the articles specified, in 1909 and 1899, was as follows:

Cost in acres.

Article.	Corn.		Wheat.		Cotton.		All crops averaged.	
	1909.	1899.	1909.	1899.	1909.	1899.	1909.	1899.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Stove	1.4	2.3	1.4	2.7	1.0	1.5	1.3	2.1
Shotgun	.7	1.4	.7	1.7	.5	.9	.7	1.3
Buggy	5.1	8.3	4.9	9.6	3.5	5.3	4.7	7.4
Cream separator	3.9	7.6	3.8	8.9	2.7	4.9	3.6	6.8
Grindstone	.2	.4	.2	.5	.2	.3	.2	.4
Harness (single)	1.2	1.8	1.2	2.1	.8	1.1	1.1	1.6
Harrow	.7	1.1	.7	1.3	.5	.7	.6	1.0
Manure spreader	6.8	11.8	6.6	13.8	4.7	7.5	6.3	10.6
Mower	3.1	5.4	3.0	6.3	2.1	3.5	2.9	4.8
Plow (turning)	.8	1.3	.7	1.5	.5	.8	.7	1.1
Saddle	1.1	1.7	1.1	2.0	.8	1.1	1.0	1.5
Tedder	1.9	3.2	1.9	3.8	1.3	2.1	1.8	2.9
Wagon (single)	3.1	5.2	3.0	6.1	2.2	3.3	2.9	4.7
Wagon (double)	4.5	7.1	4.4	8.3	3.1	4.6	4.2	6.4

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If we represent by 100 the quantity which could be purchased in 1899 with the value of 1 acre of corn, wheat, etc., the relative quantity which could be purchased with the value of 1 acre in 1909 was as follows:

Purchasing power in 1909, compared with 1899, represented by 100, of the value of 1 acre of farm crops indicated.

Article.	Corn.	Wheat.	Cotton.	Average, all crops.	Article.	Corn.	Wheat.	Cotton.	Average, all crops.
	P. ct.	P. ct.	P. ct.	P. ct.		P. ct.	P. ct.	P. ct.	P. ct.
Coal oil	190	228	176	183	Steel wire	170	203	157	164
Coffee	162	195	151	157	Wire, fence	169	203	157	163
Flour	133	167	125	130	Axle grease	172	206	159	166
Lard	117	140	109	113	Buggy whips	169	203	156	163
Matches	179	214	166	173	Corncutters	164	196	152	158
Salt	156	185	144	151	Churns	159	190	146	153
Soap	170	204	158	164	Halters	159	191	148	154
Starch	174	208	161	168	Horse blankets	159	191	149	155
Sugar	164	197	152	159	Hoes	155	186	143	150
Tobacco	166	198	154	160	Picks	167	199	154	161
Brooms	116	139	108	112	Sprayers	171	206	159	165
Dish pans	164	197	152	159	Scythes	154	184	143	149
Dinner plates	169	202	158	164	Carbolic acid	153	184	142	147
Fruit jars	166	199	154	160	Copperas	179	214	166	173
Kitchen chairs	158	189	147	152	Lime	155	186	144	149
Lamps	170	204	158	165	Paris green	158	190	147	153
Tin pails	168	202	156	163	Sulphur	179	214	166	173
Wooden buckets	148	178	138	143	Witch-hazel	179	214	165	173
Wooden washtubs	152	182	141	147	Baskets	136	163	126	132
Gloves	151	181	140	147	Milk cans	173	200	158	165
Hats	159	189	146	153	Milk pails	163	195	151	158
Jumpers	147	177	137	143	Paints	142	168	132	136
Overalls	145	175	135	141	Paint brushes	159	190	147	154
Rain coats	146	177	140	141	Rope	163	195	151	157
Rubber boots	138	161	129	134	Sacks	139	167	129	134
Shirts, flannel	151	180	139	144	Scales	164	197	153	160
Shoes	134	165	127	133	Twine	166	199	154	161
Calico	141	169	130	136	Stoves	161	193	150	156
Muslin	143	171	132	138	Shotguns	194	233	180	188
Sheeting	140	168	130	136	Buggies	164	196	152	158
Axes	164	198	153	159	Cream separators	196	235	182	190
Barb wire	167	200	155	162	Grindstones	163	195	151	157
Dungforks	161	192	149	156	Harness	149	179	138	144
Hatchets	163	195	151	129	Harrows	158	189	146	153
Lanterns	167	201	155	163	Manure spreaders	174	208	161	168
Nails	169	202	157	163	Mowers	174	208	161	168
Pitchforks	160	191	148	155	Plows	168	201	156	162
Pincers	168	202	156	162	Saddles	157	188	145	151
Saws	165	197	153	160	Tedders	167	200	155	161
Screw hooks	170	203	157	164	Wagons, single	167	201	155	162
Screw eyes	171	205	158	165	Wagons, double	157	189	146	152
Steel traps	159	191	148	154					
Shovels	162	195	151	157	Average, all articles	160	191	148	154
Staples	165	197	153	159					

From the foregoing data it appears that, whereas the value of an acre of the farmer's crops in 1909 was 72.7 per cent more than in 1899, and the cost of articles purchased increased about 12.1 per cent, the purchasing power of the produce of 1 acre in 1909 was about 54 per cent greater than the purchasing power of the produce of 1 acre in 1899. An acre of corn having increased 78.6 per cent in value, its purchasing power increased 60 per cent; an acre of wheat having increased 114 per cent, its purchasing power has increased 91 per cent; and an acre of cotton having increased 65.6 per cent, its purchasing power has increased about 48 per cent.

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REPORT OF THE LIBRARIAN.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE LIBRARIAN,
Washington, D. C., September 26, 1910.

SIR: I have the honor to submit herewith the executive report of the Library for the fiscal year ended June 30, 1910.

Respectfully,

CLARIBEL R. BARNETT,
Librarian.

Hon. JAMES WILSON,
Secretary of Agriculture.

WORK OF THE YEAR.

In presenting the report of the Library for the past fiscal year it may be said in general that it has been one of decided growth in all branches of the work. The Library appropriation exceeded that of any previous year, the staff was larger, and the routine work accomplished correspondingly greater. The accessions in books and periodicals also outnumbered those of any previous year, and the statistics of the use of the Library show an increase of 15 per cent. The following report on the work accomplished bears testimony to willing, faithful, and efficient service on the part of the staff.

ROOMS.

With the growth of the Library and its various activities there has not been, unfortunately, any corresponding increase in the amount of space at its disposal. In the last report of the Library attention was called to the need of more room. This need has now become imperative, and unless it is provided for in the immediate future the work and usefulness of the Library will be very seriously handicapped. During the past year a small amount of additional shelving was purchased and about two-thirds of the books in the Library were shifted in order to relieve the congestion at different points, but the crowded condition is now past relieving through such means. Furthermore, all the space available for shelving has been made use of. With shelves filled to overflowing with books it is impossible to keep them in an orderly condition, and as a result many of them are misplaced and much time is wasted in searching for them. Not only are the book rooms crowded, but also the workrooms. The cataloguing

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room, which is a room 22 by 20½ feet in size, with only two windows, and these below the level of the ground, has in it seven desks and seven large catalogue cases. At three of the desks artificial light is necessary much of the time. It is impossible under such conditions to accomplish the maximum work. In order to relieve effectually the present crowded condition and provide space for the growth of the next four years, at least four additional rooms are urgently needed.

USE OF THE LIBRARY.

During the past year the charges recorded at the loan desk numbered 35,180, an increase of 4,574 as compared with the previous year. The record of similar charges for the past five years is as follows:

Record of use of the Library for the fiscal years 1906 to 1910.

Month.	Fiscal year.					Month.	Fiscal year.				
	1905-6.	1906-7.	1907-8.	1908-9.	1909-10.		1905-6.	1906-7.	1907-8.	1908-9.	1909-10.
July	988	1,078	1,375	1,642	2,490	February	1,933	1,715	2,380	2,798	3,221
August	1,170	1,378	1,446	1,455	2,334	March	1,895	1,894	1,969	3,000	3,310
September	1,210	1,088	1,270	1,893	2,540	April	1,634	1,885	1,669	3,169	2,804
October	1,436	1,594	1,789	2,714	2,610	May	1,524	1,604	1,981	2,913	2,708
November	1,782	1,599	2,051	2,406	3,567	June	1,468	1,322	2,001	2,873	2,917
December	1,381	1,832	1,918	2,682	3,315						
January	1,645	2,005	2,621	3,061	3,364	Total	18,066	18,994	22,470	30,606	35,180

In connection with the statistics of the use of the Library it is necessary to explain each year that the above figures do not include (1) a record of the circulation of single unbound numbers, (2) a record of the use of the books deposited in the various bureaus and divisions of the Department, (3) a record of the books used in the Library.

A separate record of the books borrowed from other libraries was not kept previous to February, 1909, and it is, therefore, impossible to compare the number borrowed during the past year, namely, 4,701, with the record for the whole of the previous year, but the average number borrowed each month from February to June, 1909, can be compared with the average number borrowed each month from July, 1909, to June, 1910, which averages are, respectively, 339 and 391. As in previous years, we have made most frequent demands on the Library of Congress, the Library of the Surgeon-General's Office, and the Library of the Geological Survey, and to these libraries our special thanks are due. While our demands on other libraries have not been so frequent, they have been all met in the same generous spirit. The help which the work of the Department has received through the loan of books from these various libraries is greatly appreciated. A few years ago it was a somewhat rare occurrence for this Library to borrow books from libraries outside of the city, but during the past year or two such loans have become frequent. By reason, however, of the superior library resources of Washington, only a comparatively small per cent of the books requested and not contained in this Library need to be sought for outside of the city.

The number of books borrowed from this Library during the past year by scientists outside of the city was 548, an increase of 132 as

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compared with the previous year. The statistics of such loans for the past four years, arranged geographically, are as follows:

	Fiscal year.					Fiscal year.			
	1906–7.	1907–8.	1908–9.	1909–10.		1906–7.	1907–8.	1908–9.	1909–10.
Alabama	7	1	.....	.....	New Jersey	.....	.....	3	2
Alaska	.....	2	.....	.....	New Hampshire	.....	4	3	.....
Arizona	31	18	13	11	New York	21	55	53	91
Arkansas	.....	1	.....	.....	North Carolina	2	24	18	38
California	10	6	1	10	North Dakota	.....	3	.....	2
Colorado	4	2	7	4	Ohio	15	4	17	13
Connecticut	32	15	10	41	Oregon	.....	9	1	24
Delaware	.....	1	.....	.....	Pennsylvania	4	18	38	4
Florida	13	56	81	54	Rhode Island	.....	.....	.....	1
Georgia	.....	1	1	7	South Carolina	.....	.....	3	.....
Illinois	13	9	11	16	Tennessee	4	5	3	9
Indiana	9	7	2	2	Texas	5	4	1	12
Iowa	.....	.....	2	6	Vermont	8	4	16	14
Kansas	.....	1	1	2	Virginia	1	13	28	28
Kentucky	.....	.....	.....	3	Washington	4	9	1	6
Louisiana	9	8	12	13	West Virginia	9	.....	.....	2
Maine	1	7	17	9	Wisconsin	3	13	9	4
Maryland	9	16	12	8	Wyoming	4	.....	1	6
Massachusetts	11	35	3	8	Canada	.....	.....	1	.....
Michigan	5	4	7	8	Hawaii	5	11	14	3
Minnesota	1	11	9	8	Jamaica	.....	.....	1	.....
Mississippi	.....	.....	2	1	Mexico	.....	.....	.....	1
Missouri	7	7	4	4	Porto Rico	.....	1	2	52
Montana	.....	.....	1	3					
Nebraska	.....	6	12	18	Total	248	391	416	548
Nevada	1	.....	.....	.....					

From the statistics given above it will be seen that the use of our books outside the city has more than doubled in the past four years. By far the greater number were sent to scientists connected with the state agricultural colleges and experiment stations. Although this library is a reference library and its first duty is unquestionably to the Department, it is also its duty to serve the agricultural colleges and experiment stations, and as a part of that service it has been the policy of the library to extend the use of its collections to the scientists connected with these institutions as far as it is possible to do so without interfering with the work of the Department. It is understood that the privileges which the library is able to extend in connection with the lending of its books outside of the Department are necessarily limited, and, as far as known, they have not been abused nor has the lending of the books interfered perceptibly with the work of the Department. But even if the work were interfered with to some extent, as an offset to this, and by far overbalancing it, must be considered the many favors and benefits which scientists connected with the Department have enjoyed through the generous policy of other libraries in lending books for use in the work of the Department. An analysis of the items borrowed for use outside of the city showed that about two-thirds of them were periodicals. When some cheap and simple method of exact reproduction is perfected, the problems connected with the interlibrary loans will be greatly reduced. It will then be feasible, when only parts of volumes are needed, to make copies of the articles to send out of the city instead of sending the volumes.

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LIBRARY PUBLICATIONS.

The publication of the quarterly bulletin of accessions entitled "Accessions to the Department Library" was continued through the calendar year 1909. The bulletins (Nos. 73 and 74) for the two quarters from July to December, 1909, comprised 131 pages, an average of 65 pages to a bulletin. As a quarterly bulletin is too infrequent and a bulletin of 65 pages too large for satisfactory use as a record of current accessions, it was decided to discontinue the quarterly list of accessions and to publish in its place a monthly bulletin, beginning with January, 1910. The six numbers for the period January to June, 1910, have been paged consecutively and comprise 167 pages. The classified subject arrangement which has been found useful in the quarterly bulletins has been continued in the monthly bulletins. At the end of the year an author index will be issued. As a list of accessions the Monthly Bulletin has the advantage of more frequent issue and with the publication of an author index at the end of each year its permanent usefulness as a bibliography of agricultural and scientific literature will be greatly increased. The title was changed from "Accessions to the Department Library" to "Monthly Bulletin," in order to make it more comprehensive, since it is planned to include other matter besides the list of accessions. On the back cover have been printed lists of some of our desiderata. By calling attention in this way to our wants it is hoped that we will be able to acquire many publications needed to complete the library files.

In addition to the Monthly Bulletin the regular series of library bulletins will be continued. It will include the miscellaneous publications of the library, such as special lists and bibliographies on various subjects. In December, 1909, was issued in this series Bulletin No. 75, entitled "List of periodicals currently received in the library of the United States Department of Agriculture." The list was prepared by the Assistant Librarian, Miss Emma B. Hawks, and comprises 72 pages.

The Report of the Librarian for 1909, a pamphlet of 16 pages, was issued in November, 1909.

MAILING LISTS AND FOREIGN EXCHANGES.

In the last report of the Library considerable space was given to a statement on the various mailing lists in charge of the Library. As there have been no decided changes in the lists during the past year, a detailed statement in regard to them is not given in the present report. In addition to having charge of the "Libraries List" and the various foreign mailing lists, it has also been the duty of the Library for some years to attend to the miscellaneous requests from foreign countries for publications of the Department. There has been a certain propriety in having this work in charge of the Library, in view of the close connection between exchanges and the distribution of publications. There is no doubt that by reason of its connection with the distribution of Department publications the Library has been able to increase greatly the number and value of its exchanges. But, in view of the tendency toward centralization in the distribution of government publications, it is a question whether it would not per-

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haps be advisable to transfer the work to the Division of Publications if some satisfactory cooperative arrangement can be made with the Division of Publications and the various bureaus and offices whereby the Library may have the same facilities for obtaining exchanges that it now enjoys. The time which the work in connection with the mailing lists and the distribution of publications has hitherto required of the Library could then be spent to greater advantage on that part of the work more closely connected with the activities of the Library, namely, the work of obtaining exchanges.

It is gratifying to note that there is apparently an increasing willingness on the part of the bureaus and offices of the Department to cooperate with the Library in the matter of exchanges. Their willingness to have them addressed to the Library is especially appreciated, as the Library is thereby better able to keep the files complete and up to date. It is also most desirable to have in one place information in regard to all the publications received at the Department. This arrangement in regard to exchanges, which may perhaps not unfittingly be described as a pooling of interests, undoubtedly works to the mutual advantage of the bureaus and offices of the Department.

ACCESSIONS.

The number of books, pamphlets, and maps added to the Library during the year was as follows:

Purchases:		
Volumes	1,454	
Pamphlets	65	
Maps	8	
Continuations	1,574	
Total		3,101
Gifts:		
Volumes	488	
Pamphlets	387	
Maps	43	
Continuations	2,728	
Total		3,646
Volumes made by binding periodicals and serials		1,409
Grand total		8,156

In addition to the accessions noted above, all of which were catalogued, there were received 91 volumes, 286 pamphlets, 590 continuations, and 1 map, which had not yet been catalogued on July 1, 1910. The total recorded number of books and pamphlets in the Library on July 1, 1910, was 109,630.

Besides new books, the Library was able to purchase during the year many rare old botanical, horticultural, and zoological works from our lists of desiderata. Considerable progress was also made in completing imperfect files of important periodicals. Among the sets completed may be noted the following:

Annalen der oenologie.
Annales forestières et métallurgiques.
Archief voor de Java suikerindustrie.
Bulletins d'arboriculture, de floriculture et de culture potagère.
Deutsche dendrologische gesellschaft. Mittheilungen.
Deutsche entomologische zeitschrift Iris.

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Entomologists' annual.
Flora and sylva.
Forstliche blätter.
Forstliche mittheilungen.
Jahresbericht über die erfahrungen und fortschritte auf dem gesamtgebiete der landwirtschaft.
Klosterneuberg bei Wien, K.K. Chemisch-physiologische versuchsstation für wein- und obstbau in. Mittheilungen.
Natuurkundig tijdschrift voor Nederlandsch Indië.
New Zealand institute. Transactions and proceedings.
Le progrès vétérinaire.
Revue bryologique.
Revue d'hygiène et de police sanitaire.
Zeitschrift für wissenschaftliche zoologie.
Zentralblatt für die gesamte physiologie.
Zentralblatt für stoffwechsel- und verdauungskrankheiten.

PERIODICALS.

The periodicals currently received during the year numbered 2,002 different titles, exclusive of annuals and other serials of infrequent issue. The number of new titles added during the year was 136. Of the total number of periodicals received 768 were purchased and 1,234 received by gift and exchange. To the number of different periodicals purchased should be added 65 duplicates, making a total of 803 periodicals purchased. In the number of gifts and exchanges are included 305 publications of state departments and experiment stations, which, though not properly called periodicals, are nevertheless of frequent issue and are entered and circulated at the periodical desk in the same manner as the periodicals. If these 305 publications are deducted from the total number of periodicals currently received, namely, 2,002, it leaves 1,697 regular periodicals. A large proportion of the exchanges are received in duplicate, greatly adding to the amount of material handled. A count was made of the number of current unbound periodicals handled daily from May 7 to June 6, 1910, which, compared with a similar count made for May, 1909, is as follows:

	May, 1909 (25 days).	May 7 to June 6, 1910 (25 days).
New numbers received and recorded	4,523	4,923
Daily average	181	197
Returns from circulation	4,731	5,104
Daily average	189	204

It is impossible to keep a complete record for the whole year of the circulation of current periodicals, but the above statement of the circulation for a single month gives some idea of the growth of the work. The figures do not, however, give any adequate idea of the real circulation of the current periodicals. They represent little more than the circulation to bureaus and offices and do not for the most part include the circulation to individuals in those offices. For example, a periodical that is charged by us once at the periodical desk to the Bureau of Plant Industry library may circulate to fifteen or twenty individuals in the Bureau of Plant Industry before it is returned to the main Library.

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To meet the frequent demands for information regarding the periodicals received by the Library there was prepared during the past year a list of those currently received in 1909. The list, which contains 1,575 titles, is arranged alphabetically by title of the periodical and also has a subject index. It has proved to be very useful and has without doubt increased the circulation of the periodicals.

There is need in the periodical division of another assistant whose time can be entirely devoted to work with serials, of which the Library receives not fewer than 2,500 in addition to the 2,002 periodicals received. To keep the files complete and up to date requires continual vigilance and a great amount of labor and correspondence. It is hoped that much more time can be devoted to this work during the next year in order that the next printed catalogue of the periodicals and serials in the Library may not show so many imperfect files.

BINDING.

It is especially gratifying to be able to report that 3,245 volumes were prepared for the bindery during the past year, an increase of 1,335 as compared with the previous year. This is the first increase in the number of books bound that it has been possible to report since 1906, in which year 2,463 volumes were bound. The increase of the past year was due partly to the fact that more funds were available for binding and partly to the fact that it was possible to devote more time to the work. It is hoped that it will be possible to report a still greater increase in the next fiscal year. When the number of current periodicals and serials received by the Library is taken into consideration it is evident that at least 5,000 volumes should be bound each year. Even with that annual increase it will be some years before it will be possible to catch up with the arrears which have accumulated.

In addition to the 3,245 volumes sent to the government bindery, 128 volumes of periodicals were put in temporary binders. These binders are used for periodicals which need to be preserved, but which are not so frequently used as to justify permanent binding. They are also used for incomplete volumes, as they permit the insertion of the missing numbers when they are obtained, and in the meantime keep the file in an orderly condition in a form convenient for use.

DUPLICATES.

This Library accumulates a large number of duplicates of government and state publications, and also a large number of duplicate periodicals. They are sent currently as gifts to the bureaus and offices of the Department and later find their way to the Library, which in many cases has already received copies. In spite of the time consumed in handling these duplicates and the difficulty of disposing of them, it has been the policy of the Library to encourage the bureaus and offices to send their exchanges to the Library, as valuable additions are often received in this way. Many of the duplicates would, without doubt, be appreciated by other libraries, but the problem has been how to place them where they will be of use. Lack of room and assistance to devote to the care and disposal of duplicates has from time to time forced the destruction of many

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publications of probable value to other libraries. For a few years previous to the spring of 1909 the Library had the privilege, as did other government libraries, of sending its duplicates to the Library of Congress, but lack of space and assistance for the work forced the Library of Congress to discontinue this arrangement. Since that time our duplicates have accumulated. Lack of sufficient work room for sorting material and the entire lack of space for storage has rendered the problem acute. As we could not, however, bring ourselves to the point of destroying this material without at least offering it to other libraries, the best makeshift arrangement which it seemed possible to make under the circumstances was to list the material, which was then packed away in sacks and stored temporarily in a storeroom lent for the purpose through the courtesy of one of the offices of the Department. The list is now in preparation and is to be printed. Copies will then be sent to the state agricultural colleges and experiment stations for them to make selections. The future policy of the Library in connection with the disposal of its duplicates will depend largely on the demands for the items in this list. With proper cooperation and encouragement from the state agricultural colleges and experiment stations it would seem a legitimate function of this Library to act as a clearing house for the exchange of agricultural duplicates, but the expense connected with the work would not seem justified unless there is an urgent demand for the service.

CATALOGUES.

The total number of books, pamphlets, maps, and continuations catalogued during the year was 8,156. There were added to the main catalogue 25,023 cards and 3,697 were withdrawn, making the net addition 21,326 cards, an increase of 3,715 in comparison with the number added to the catalogue during the previous year. It is estimated that the main dictionary catalogue now contains approximately 240,000 cards. It contains the following: (1) Author and subject cards for books contained in this Library; (2) index cards for the publications of the Department of Agriculture; (3) index cards for three foreign agricultural journals; (4) cards published by the American Library Association indexing scientific serials; (5) cards published by the New York Botanical Garden for current botanical literature; (6) Library of Congress cards for books of interest to the Department contained in the Library of Congress and the libraries of the Geological Survey and the Bureau of Education; (7) index cards for various miscellaneous publications. From the above it will be seen that the catalogue is to some extent an index catalogue, for it contains in one alphabet not only catalogue cards for books but also index entries for articles contained in books and periodicals. Considerable difficulty has been found in combining the catalogue and index entries, but the advantages of having only one catalogue in which to look for information in regard to the resources of the Library have made us hesitate to change the present arrangement. There is, however, great need of a revision of the catalogue, especially in regard to the subject headings. It would also be desirable to have our subject headings conform as far as possible to the subject headings used by the Library of Congress,

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which are coming more and more to be regarded as the standard. The Library of Congress and this Library have in general endeavored to cooperate in regard to the subject headings relating to agriculture, but a more systematic attempt toward conformity should without doubt be made. It is hoped that within the next year it will be possible to make a beginning in the revision of the catalogue, for the longer it is delayed the greater the undertaking will be.

With the exception of the pamphlets and serials, it was possible to keep fairly up to date the cataloguing of the accessions of the past year. In order to shorten the process of cataloguing the pamphlets, which were accumulating at a rapid rate, it was decided about three years ago to make for the less important ones only temporary author cards with an abbreviated imprint and to keep the pamphlets thus catalogued in a separate collection in pamphlet boxes arranged by the subjects of the classification. As the pamphlets are kept by themselves, it will be possible to catalogue them more fully, as a whole or in part, when time permits, and, in the meantime, they are at least made available from the author side and the arrangement of them by subjects takes the place to some extent of the subject entries in the catalogue. During the past year 588 pamphlets were catalogued in this way.

The number of titles prepared during the year by the Library for printing by the Library of Congress in what is known as the "Agr" series is as follows: (1) Cards for accessions, 1,439; (2) cards for current Department publications, 405; (3) reprinted cards for Department publications, 762; (4) cards for foreign agricultural periodicals, 109; total, 2,715, an increase of 647 over the number of titles printed last year. The record of the number of titles prepared since 1902, in which year the printing of our cards by the Library of Congress was begun, is as follows:

December, 1902, to June, 1903	1,059
July, 1903, to June, 1904	880
July, 1904, to June, 1905	3,961
July, 1905, to June, 1906	1,568
July, 1906, to June, 1907	2,584
July, 1907, to June, 1908	1,286
July, 1908, to June, 1909	2,068
July, 1909, to June, 1910	2,715
Total	16,121

Since a very large proportion of the works on agriculture was catalogued previous to 1902, printed cards have been prepared for only a comparatively small part of this Library's collections on agriculture. In the subject of agriculture the Library of Congress has prepared printed cards for only the copyrighted books since 1898, its accessions by gift, purchase, or exchange received since 1901, and for the books recatalogued since that date. No accurate count of the printed cards on agriculture has been made, but it is estimated that approximately 10,000 cards are available. As it would be desirable to have printed cards for all the books on agriculture contained in this Library and the Library of Congress, the possibility of making some cooperative arrangement with the Library of Congress for the carrying out of this useful bibliographical undertaking has been considered, but on account of the pressure of other work no definite steps have been taken in the matter.

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CATALOGUE CARDS FOR DEPARTMENT OF AGRICULTURE PUBLICATIONS.

During the past year the Library has prepared cards for all the current publications of the Department, the number of titles being 405, an increase of 67 as compared with the previous year. The revision and reprinting of the cards issued by this Library previous to 1906 was also completed. Cards for all the publications of the Department for which it has thus far been deemed advisable to print cards are now available at the Library of Congress. The complete collection of author, subject, and title cards up to July, 1910, comprises approximately 14,000 cards and costs about $100. The cards issued by this Library previous to 1906 and the cards for current publications of the Department issued since that date have been distributed free to the libraries of the state agricultural colleges and experiment stations, but it was not thought justifiable, on account of the great expense it involved, for the Department to distribute free to the above institutions the set of revised cards for the publications issued previous to 1906. A very liberal arrangement was, however, made by the Library of Congress whereby libraries having sets of the old cards in the large (33°) size or the small (32°) size are enabled to exchange them for the revised set at about half of what the set would otherwise cost. As the 33° size card (about 3 by 5 inches) is now almost universally used in American libraries, it was decided during the past year to discontinue printing a special edition of the cards in the 32° or index size, but to cut to the 32° size enough 33° size cards to keep up the sets of the small size which continue to be maintained by agricultural colleges and experiment stations. The new arrangement in regard to the 32° size cards went into effect with the cards for the publications of 1910. A circular letter was sent out on February 17, calling attention to the change and to the offer of the Library of Congress referred to above in regard to exchanging sets in the small size for the revised sets in the large size. In addition to this arrangement for exchanging cards the Library of Congress, as pointed out last year, has also made provision for "verifying the files now located in libraries and experiment stations by preparing a traveling catalogue showing the cards which should be in the set and the arrangement recommended by the Library of the Department of Agriculture." It has seemed worth while to call special attention to both of these offers of the Library of Congress, as a large number of changes have necessarily been made in the author and subject headings on the old cards, and it is believed that libraries possessing the cards will wish to take advantage of one or the other offer.

BUREAU AND DIVISION LIBRARIES.

In the report of the Library for the last year a somewhat extended account was given of the various bureau and division libraries. During the past year the work of each of these libraries has grown, the collections have increased, and in some cases the material equipment has been greatly improved. It can not, however, be said that the problem of the relation of these libraries to the main Library is as yet much nearer solution. Whatever the ultimate solution may be,

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there are many evidences of the need of greater cooperation than now exists. There is at the present time an excellent spirit in this matter, but the general willingness to cooperate needs to be put in more concrete form. One of the greatest difficulties in the way at present is the lack, except in a few cases, of real familiarity on the part of the librarians of the bureaus and divisions with the methods and work of the main Library and a similar lack of familiarity on the part of the main Library with the work and needs of the bureau and division libraries. This unfamiliarity is no doubt due largely to the fact that the bureau and division libraries as now organized are independent in their administration as far as the main Library is concerned. It seems desirable that some provision be made by law whereby it will be legally possible for assistants from the main Library to be detailed temporarily to the bureau and office libraries, and librarians from the bureau and division libraries detailed temporarily to the main Library. Such an arrangement, the main object of which would be to familiarize those engaged in any part of the work with the library work of the whole Department, would without doubt result in greater cooperation and increased efficiency in the library work of the whole Department, and would also be an advantage in emergencies arising from the absence of assistants. In recommending legal provision for such an interchange of library assistants in the Department without formal transfer on the salary rolls there is no thought of making the changes compulsory in any case. To bring about the desired results the interchange must in every instance be acceptable to the bureau or division concerned as well as to the Library.

There can be little doubt that the solution for the Department of the problem of indexing and the closely related problem of bibliographical work rests largely with the librarians of the various bureaus and offices, for they come in closer contact with the work of the bureaus and divisions and are therefore better able to know their needs. If through cooperation this special knowledge is put at the service of the main Library the combined efforts ought to do much toward placing the indexing and the bibliographical work of the Department on a more satisfactory basis.

AGRICULTURAL LIBRARIES SECTION.

(AMERICAN LIBRARY ASSOCIATION.)

Special mention is made of the annual conference of the American Library Association held at Mackinac Island June 30 to July 7, 1910, in view of the fact that the two sessions of the Agricultural Libraries Round Table held in connection with the meeting represented the first attempt to bring together librarians of agricultural libraries and those interested in agricultural literature for the discussion of their special problems. Mr. J. I. Wyer, jr., director of the New York State Library, presided as chairman at the two sessions. The titles of the papers presented were as follows: (1) Agricultural libraries; (2) Traveling libraries for farmers; (3) Agricultural collections in public libraries; (4) Agricultural literature in the reference library; (5) Instruction of students in the use of agricultural and scientific literature; (6) Relation of the experiment station library to the college

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library; (7) Guides to recent agricultural literature; (8) Classification of agricultural literature; (9) Indexing agricultural literature; (10) Agricultural periodicals, their selection and preservation. The sessions were well attended and the papers and discussions were interesting and helpful. At the close of the meeting it was voted that the officers of the American Library Association be communicated with in regard to forming a permanent Agricultural Libraries Section. Such a section should be effective in bringing about closer cooperation among agricultural libraries, in furthering their advancement, and in stimulating interest in agricultural literature.

As further evidence of the increasing interest in agricultural libraries and agricultural literature and of the efforts on the part of librarians to serve the farmers, it is also of interest to note that the League of Library Commissions, which held its seventh annual meeting in connection with the American Library Association conference at Mackinac, devoted one of its sessions to the general subject of commission work with the farmer. The following papers were presented: (1) The farmer, his book and his heart; (2) Possibilities of direct service to individual farmers, including the location of traveling libraries through granges, agricultural societies, farmers' clubs, rural schools, etc.; (3) Cooperation on the part of the commission with public libraries in their efforts to reach the farmer.

The papers presented at the meetings of the Agricultural Libraries Round Table and the League of Library Commissions are to be published in whole or in part in the Proceedings of the American Library Association and will form an interesting contribution to a branch of library work which has hitherto received little attention.

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REPORT OF THE DIRECTOR OF THE OFFICE OF EXPERIMENT STATIONS.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., October 15, 1910.

SIR: I have the honor to present herewith the report of the Office of Experiment Stations for the fiscal year ended June 30, 1910.

Respectfully,

A. C. TRUE, *Director.*

Hon. JAMES WILSON,
Secretary of Agriculture.

INTRODUCTION.

As in previous years, the work of the Office of Experiment Stations during the last year has included the supervision of the expenditures of federal funds by the agricultural experiment stations in the several States; conferences and correspondence with station officers regarding the management, equipment, and work of the stations; the collection and dissemination of information regarding the progress of agricultural education and research throughout the world by means of technical and popular bulletins; the management of the agricultural experiment stations in Alaska, Hawaii, Porto Rico, and Guam; the promotion of the interests of agricultural colleges and schools and farmers' institutes throughout the United States; special investigations on irrigation and drainage conducted largely in cooperation with experiment stations, educational institutions, and other agencies in different States and Territories; and the investigation of problems relating to the food and nutrition of man.

RELATIONS WITH AGRICULTURAL EXPERIMENT STATIONS.

The duties of the Office in relation to the work and expenditures of the experiment stations continue to increase in volume and in variety. This results from the growing complexity of the business of the stations now that the Adams fund has reached the maximum and state funds have been largely increased. The multiplicity of duties which the stations are now expected to perform requires greater attention to general policy as applied to the use of the federal funds, and raises a large number of questions in the administration of the experimental and research work.

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To meet the demand for studies of problems involving special or local conditions, the work of the stations is being scattered over the States more broadly than formerly. Not only are demonstration and experimental farms being conducted under state appropriations, but the station experts are extending their investigations to particular localities. Where the Adams fund is expended in connection with such investigation away from the station it has been deemed desirable to include it in our annual inspection, and this increases the time required for an examination of the station work.

The wisdom of a close scrutiny of the work and the expenditures under the federal funds continues to be evident. The growth of interest in the teaching work of the colleges and in extension work has led to conditions calling for a reapportionment of salaries in a number of cases. The Office continues to insist that the colleges and the States must make full provision for the teaching and extension duties.

One result of the growing activities of the stations has been a too general use of the Hatch fund for administrative and similar expenses without sufficient definite experimental work. The Office has maintained that the Hatch fund should not be drawn upon to provide for the general administration of the stations operating with liberal state appropriations, but that definite experimental work should be in progress under the Hatch fund as well as the Adams fund. It is more and more evident that those stations which have no regular state appropriations will find increasing difficulty in meeting the calls made upon them by their constituents in the way of simple or local trials, the giving out of general information, answering miscellaneous correspondence, preparation of popular bulletins, etc. We have strongly urged the procuring of state appropriations and have enforced the necessity of this by holding the use of the federal funds strictly for experimental purposes. Such state appropriations are now available in a large majority of cases.

Several cases have arisen during the past year which have called for an unusual amount of attention from the Office. These have usually arisen in connection with the removal of the director of the station. In such cases where the efficiency of the station work under the federal funds has been involved it has been necessary for the Department to interfere and to prescribe conditions which must be recognized and met by the local authorities. In some instances this has resulted in the temporary withholding of the federal funds and in the enforcement of the principles which must govern in the selection of station officers and in the management of the institution. There continues to be within some boards of control a wrong impression of their duties to the station and a wrong attitude toward its conduct. The practice of interfering in the conduct of work after the general plan has been approved, and with the expenditure of the funds for the purposes necessary to carry out such work, is a misconception of the duties of a board of control, which it has been necessary to resist in a number of instances.

During the past few years the work of the agricultural colleges has expanded in various directions. The number of students of college grade has greatly increased, the range and number of courses of instruction has materially enlarged, and the activities of the colleges in various lines of extension work have been greatly multiplied. At

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the same time their funds for experimental work have more than doubled. These institutions are therefore in constant process of reorganization and in many places the readjustment of the organization has not kept pace with the increase of duties. It is evident that a more ample plan of administration must be adopted before the most efficient service in all lines can be performed. Presidents and deans are not the only administrative officers required by the new situation.

The experiment station, as the research division of the college, has in itself become of such size and importance that it needs a distinct officer to administer its affairs. The proper management of an experiment station having an annual income of from $30,000 to $75,000 or more and operations covering many branches of agricultural science and practice, with vital relations to the daily interests of many thousands of people, is a large matter and involves a heavy responsibility. To achieve the best results the station director should follow the business of the station closely, know definitely what is going on in the different departments, and study carefully the relation of the station's work to that of other similar institutions and to the agriculture of the State, the nation, and the world. This can hardly be done in a satisfactory way when his service as director is merely incidental to other exacting and time-consuming duties. The attempt to cover so much administrative ground is too often shown in the lack of a clearly defined policy, the absence of adequate supervision of expenditures, and general unfamiliarity with the plans and work of the several departments. Very many of the difficulties in detail encountered by the Office in the supervision of the federal funds given to the stations now arise from lack of adequate local administration. The Office is therefore urging the consideration of this fundamental question and has widely discussed it with station officers during the past year.

In several States there has been an increased tendency toward differentiation of effort and duties on the part of the station staff, relieving them in large degree from college and inspection work and extension duties. Such a conserving of their time and relief from distracting interruption is proving to be a great advantage, which is reflected in more advanced and productive investigations and in a greater attractiveness of the positions. Men are coming to consider the opportunity for work, represented by the conditions, as well as the salary which the position carries.

While the Office is following closely and criticising frankly the work and expenditures of the stations, it is also deeply impressed with the augmenting scientific and practical strength and importance of their operations, as well as the growing appreciation of the value of their results by the agricultural people throughout the United States. The granting of federal aid to original research under the Adams Act has been abundantly justified in that it has materially raised the level of scientific aim and accuracy of the operations of the stations. Instead of minimizing their more practical work this has led the States to increase largely their funds for substations and special experimental work. The American system of agricultural experiment stations is therefore more comprehensive, far-reaching, and permanently established than ever before.

One further step is needed to complete this system and demonstrate to the world that our agricultural progress is being permanently assured because it rests on a scientific foundation. A suitable

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agency for publishing the research work of the stations is still lacking and the need for this is becoming more acute as time goes on. Investigations in various lines are being brought to completion and the data await publication. In one instance very extensive records of the relation of feed to the requirement of dairy cows have been in progress for many years, without any visible outlet for their publication. In another the results of bacteriological studies of the soil in relation to fertility are filed away ready to be published when opportunity offers. Others, embodying the results of long-continued field experiments, are confined to the record books of the station, and the product of studies upon the principles of breeding plants and animals are accumulating in volume. There is at present no outlook in sight for the publication of a series of fundamental studies on the function of food in animal nutrition, physiological investigations in relation to ventilation, investigations on the rusts of plants, the relation of environment to disease in plants, life-history studies of economic insects, and a long list of investigations of a character too technical for presentation in the station bulletins. In a number of known instances the attempt has not been made to compile the data for final publication because of the lack of any suitable agency through which to issue it; and this difficulty of securing adequate publication has been a discouraging element to station investigators, who have seen the readiness with which more popular work was printed and the interest and credit which it brought. The encouragement of research would be one of the most potent results of providing a suitable scientific journal for the presentation of results.

In one or two instances the pressure upon the stations has been relieved by starting a technical series of bulletins, but this is only partially satisfactory, as the bulletins are easily lost and the accounts of the work are widely scattered. The individual articles do not reach the scientific readers they should, and they are not listed and indexed with scientific publications, and hence are likely to be lost sight of in a short time. The experience with the station bulletins in the past is an indication of the unsatisfactory character of a technical series for the research work. Collections of these bulletins are very largely confined to the libraries of a few institutions and still fewer individuals, with the result that often the only record of the station investigations available to the general public is to be found in abstract journals. Aside from this, the results of these researches are not merely of local interest within the State where they are made, but are most of them of national interest as marking the progress of science in agriculture. Their publication in a form which will be conveniently accessible is therefore a matter of national concern.

In some instances the purely practical deductions from these investigations have been set forth in popular bulletins, which, however, give a decidedly inadequate idea of the real character of the investigations or of the nature of the data upon which the summaries rest. The publication of these researches in technical and scientific journals has met with only partial success, the objection being that the papers are widely scattered and they do not reach the audience it is desired to reach. A considerable number of papers have been published in foreign periodicals and in a foreign tongue. One worker has had accepted by a foreign journal of agricultural science a paper which has been awaiting publication for over a year. The

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same worker has tried the publication of his work in an American technical journal, but finds it does not reach the proper audience. We are thus obliged to confess to a humiliating lack of a proper American medium for the presentation of such material to the world, though we are maintaining the most comprehensive system of institutions for agricultural research.

There is now very active interest among station workers in this matter of a suitable organ for the publication of their work. The material for publication is already accumulating, and the wide interest at present felt in agriculture makes the collection and preservation of these papers a matter of the utmost importance at this juncture.

RELATIONS WITH INSTITUTIONS FOR AGRICULTURAL EDUCATION.

During the past year there has been a very rapid development of public interest in the broader phases of agricultural education. It is now clearly seen that the right solution of the problems of country life and agricultural production will depend very largely on an effective system of practical education which will reach the masses of men, women, and children on the farms. The complexity of the problems involved in organizing proper agencies for such education and the immensity of the task involved in reaching the millions of our rural population are as yet only dimly realized. The relations of the national and state departments of agriculture, the agricultural colleges, schools and experiment stations, and public and private schools to this movement are not yet well defined. Special problems are constantly arising in different regions. Attempts are being made in many places to organize this work without taking into account the results of experience elsewhere. State and local officials and organizations, voters, and men and women interested in promoting the general welfare of our agricultural communities, are seeking light on the questions involved in the organization of agricultural education. This Office is endeavoring to study these problems in a broad way, to collect information from many sources, and to spread abroad throughout the country definite information which may be of use to those who are engaged in the work of diffusing practical education in agriculture in the several States. A part of this work can be done through publications, but much of it requires personal touch with the communities and officers seeking our aid. Our work under present conditions is entirely inadequate to meet the situation. Confining our efforts to giving aid to the state organizations and officers charged with the immediate responsibility for promoting this movement, we need a larger and more permanent force than can be maintained with the funds now at our disposal. Our agents for this service should be men and women with broad educational and practical training, and with marked ability to present the subject clearly and effectively in publications, addresses, and conferences. Much of their success will depend on their continuance in our service after their ability for broad leadership in this enterprise has been demonstrated. The amount of money required to secure and maintain the needed force for such service as is appropriate for the Department of Agriculture to perform in promoting agricultural education throughout the United States is relatively very small. It is hoped, therefore, that a way will be found to provide such additional funds as will enable

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our agricultural education service to meet more fully the demands which the States and Territories are making upon it.

I recommend that at least $10,000 be added to the appropriation for the work of this Office in agricultural education for the fiscal year 1912.

The educational work of the Office is divided into two sections, one dealing with agricultural colleges and schools and the other with farmers' institutes and other forms of extension work in agriculture.

THE AGRICULTURAL COLLEGES AND SCHOOLS.

The recent growth of sentiment in favor of agricultural education through colleges and schools has been more rapid than even the most sanguine friends of the movement dared to anticipate. Since October, 1908, the number of institutions in the United States giving instruction in agriculture has increased from 545 to 875, a gain of 330 institutions. In other words, the lists published by this Office in May of this year contained 60 per cent more names of colleges and schools teaching agriculture than did the lists published nineteen months earlier.

This remarkable increase in the facilities for agricultural education has occurred largely among the secondary institutions—the agricultural high schools and the public and private high schools and academies, of which there are now 630 with students in agriculture. This number does not include normal schools and other institutions conducting teacher-training courses in agriculture, of which there are now 214. Much of this work is secondary, but some of it is elementary and some collegiate.

Such developments among the institutions that look to the agricultural education service of this Office for publications and for advice concerning teachers, courses of study, equipment, methods of instruction, and in general, the relation of their work to the practical problems involved in agricultural production and the satisfactory development of home and social life in rural communities, have naturally resulted in heavier demands upon this service than could be met satisfactorily with exactly the same staff and the same appropriation as in the previous year. Consequently the work of the Office in relation to agricultural colleges and schools has not changed materially. We are aiding them as far as we can, but very inadequately.

There has been, as formerly, clearing-house work for these institutions, cooperation with them and with associations representing their interests, and expert services in connection with the inauguration of new agricultural educational institutions, courses, and projects. This work has been in charge of Mr. D. J. Crosby, specialist in agricultural education, who has been assisted by Mr. F. W. Howe, assistant in agricultural education; Miss M. T. Spethmann, in charge of statistics and the review of foreign literature on agricultural education; and Miss M. A. Agnew, in charge of the card directory of teachers and investigators in agriculture and of the organization lists of agricultural colleges and experiment stations.

In addition to the regular editorial work of the agricultural education service in connection with the department of agricultural education

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in the Experiment Station Record, which involved the review of more than 3,000 American and foreign publications, and the preparation of the annual organization lists, statistics, review of progress in agricultural education, and lists of educational publications and institutions, the service has published special bulletins and circulars concerning secondary agricultural education, boys' and girls' agricultural clubs, forestry in nature study, normal school instruction in agriculture, and testing seed corn in school, and has submitted for publication manuscripts dealing with a secondary course in animal production, agricultural instruction in the public high schools of the United States, school exercises in plant production, and school lessons on corn.

Studies of American and foreign schools in which agriculture is taught have been continued. The card index relating to the American schools now contains over 6,000 cards. The card directory of American teachers and investigators in agriculture has undergone its annual revision and now contains about 2,100 names. In connection with the directory, a list of applicants for positions and a list of vacancies in institutions are kept closely up to date. The directory and these lists facilitate greatly the large correspondence of the Office regarding the personnel of the institutions concerned.

Educational work in cooperation with the Association of American Agricultural Colleges and Experiment Stations has been continued. The Director of this Office has continued to act as bibliographer of the association, as chairman of its committees on instruction in agriculture and on the history of agricultural education, and as dean of the Graduate School of Agriculture, the fourth session of which was held at Ames, Iowa, during July of this year. The specialist in agricultural education, as secretary of the association committee, has recently submitted for publication a secondary course in animal production, which was prepared for the committee by Prof. H. R. Smith, of the University of Nebraska.

The specialist in agricultural education and his assistant have attended many conferences and large educational gatherings and have assisted school officers and teachers in many ways through correspondence and personal advice. The Office has also occasionally sent out other members of its staff and specialists from other bureaus to address educational gatherings and to assist agricultural schools along their lines of specialization, and would employ this very effective method more freely if funds for travel were available. Cooperation with other bureaus of the Department has also taken form in the preparation of educational bulletins and circulars. One circular prepared in the Forest Service has been published and a bulletin on rural school consolidation, prepared by a special agent of the Bureau of Statistics, has just recently come from the press. Cooperation along these and other similar lines might well be extended with resulting great benefit to the colleges and schools that are endeavoring to carry in an effective way, to the people living upon the land, the results of investigation on the part of this Department and the state agricultural experiment stations.

Plans for 1911–12.

During the ensuing fiscal year there will be no material change in the work of the agricultural education service of this Office. The

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work in hand will be carried on, but there will not be sufficient funds for the investigation of specific problems in agricultural education, nor for the preparation of several much-needed publications requiring the accumulation of original data. This will be a serious handicap to the usefulness of the service, because just at this time of rapid development a relatively large amount of field work among educational institutions is desirable and necessary, if the Office is to perform its logical function as a clearing house for agricultural education in the United States.

Numerous state conferences of college and normal school men, superintendents of education, representatives of agricultural associations, and others influential in public affairs are being held, and many more are likely to be held in the near future, to discuss and decide upon a rational policy for the promotion and organization of agricultural instruction in the colleges, normal schools, and public schools, and in nearly every case this Office is asked to send some one to the conference in an advisory capacity, some one who can give the delegates a broader view of the situation than that bounded by state lines, who can give them advice based on the experience of other States in similar lines. It would seem to be a legitimate and important function of the agricultural education service of this Office to perform such services; but if the Office is to give sound advice in these matters it must have information based upon a careful and minute study of methods and facilities used and results attained in agricultural colleges and schools all over the United States and in other countries where conditions are comparable with our own.

Neither attendance at these important conferences nor a comprehensive study of agricultural education can be made with existing available funds. There should be additional specialists in agricultural education to make the necessary investigations and additional clerical assistance to help in preparing the results of these and other investigations for publication, in order that each new project in the teaching of agriculture may have the accumulated experience growing out of the development of other like projects.

FARMERS' INSTITUTES AND EXTENSION WORK.

Forty-two States and Territories have reported upon their farmers' institute work for the past year. One State had no institutes owing to the failure of its legislature to make appropriation for the purpose. The other 41 give the entire number of institutes held at 4,879. This is a gain of 231 over the number held in these States the previous year.

Of the 4,879 institutes held, 3,002 were one-day institutes, 1,713 two-day, and 164 three or more days. The year before the same States reported 4,748 institutes, of which 2,892 were one-day, 1,716 two-day, and 140 three or more days, showing that the tendency is to increase the number of one-day institutes, due, no doubt, to an effort by the state directors to accommodate a larger number of localities with institute service.

The most reliable method for determining the progress of the work is through the number of sessions and the average attendance at these sessions. Estimated by this method, the institutes for 1909–10 are considerably in advance of those of any previous year. Forty States report 14,964 sessions, an increase of 4,743 over the

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year before. The attendance at the regular institutes in 40 States reporting was 2,188,640, as against 2,137,862 for the same States the previous year. If the States that have not yet reported show an attendance equal to that of the year 1909, the total for the past year will reach 2,291,703, a gain of 50,778.

The appropriation in 40 States for institutes for the year was $386,126.04. The amount for the previous year for these States was $323,482.90, showing an increase for the past year of $62,643.04. If the other States not reporting equal their appropriations for 1909, the total for 1910 will amount to $408,309.63, a much larger sum than has heretofore been given for institute support in any single year in the history of the institute movement.

In addition to carrying on the work of the regular institutes the States have been maintaining numerous special meetings of institute character. Several of these special forms of activity are rapidly becoming of such importance as to require organizations of their own to be specially equipped for rendering the particular kind of service that each interest requires. One of these special forms is the movable school of agriculture. Ninety-one of these schools were held last year, with an attendance of 65,977. Field demonstration is also rapidly coming into use as a most effective method of teaching agriculture to farming people. One State reports an attendance of 1,100 persons upon these demonstrations and others held meetings of this character with great advantage, but have failed to indicate the number in attendance.

The agricultural train is another form of institute activity that has developed with great rapidity and promises to be an effective means of disseminating agricultural information. Twenty-six trains are reported to have been run during the year, with an attendance of 182,745. To equip and conduct an instruction train so as to serve in the best possible way the interests of farming people requires careful planning as to routes to be taken and subjects to be presented and a special outfit of men and material. There is room here for special study by experts to make this character of work most efficient.

Four hundred and one women's institutes were held during the year, with an attendance of 4,850. This is a comparatively new field of education and one that is worthy of special attention by institute directors. In developing this form of extension the institute is endeavoring to direct and strengthen that which underlies all improvement in rural affairs—the character and influence of the home. Institutes for women, therefore, because of their extreme importance, ought to have recognition in future extension work equal, at least, with those for men, and institute workers should devote themselves with as great earnestness and energy to the development of this form of extension activity as they have exhibited in developing institutes for men.

One hundred and sixty sessions of institutes for young people were held during this year, with an attendance of 21,422. This is another field that has been much neglected and that needs special attention by all who are interested in or responsible for rural betterment.

The directors in two States report that 50,000 school children were visited and addressed by their institute lecturers during the year. A number of others report similar service, but do not give the schools

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visited or the number of children in attendance. It is safe, however, from the data furnished, to assume that at least 100,000 school children were visited by agricultural experts during the year and given some instruction in rural affairs.

Fourteen States held 288 independent institutes, attended by 94,523 persons. Sixteen States held 138 sessions of round-up meetings, with an attendance of 42,141. Two special-subject institutes were reported, with an attendance of 1,600, and two States reported picnics, with an attendance of 15,241, addressed by institute lecturers, while one State reports a normal class consisting of 147 persons for the instruction of teachers.

The total reported attendance at all institutes, both regular and special, for the year was 2,666,940. If the States not yet reporting show an attendance at their regular institutes equal to that of the year before, the total will be over 2,700,000.

The agricultural colleges and experiment stations have continued to aid the institutes by detailing members of their faculties and station staffs for lecture service. Four hundred and eighteen of these lecturers, representing the agricultural colleges and experiment stations in 35 States, were engaged in institute work last year. Thirty of these States report the days of service contributed by the lecturers at 3,755. In the previous year 43 States reported 459 college and station men engaged in this work, and of these States 34 reported the days contributed at 3,381. It will thus be seen that there has been a considerably larger contribution of time to institute work during the past year by the colleges and stations than was the case during the year before.

The rapid growth of the farmers' institute movement in this country compels attention to the immediate need for more qualified teachers to give instruction in agricultural institutes, colleges, and schools. The lack of a sufficient number of capable agricultural instructors, particularly for peripatetic work, is now seriously felt in all of the States, and unless some effective method is devised and introduced for enlarging the number more rapidly than existing agencies have hitherto done a most embarrassing situation will confront those who are responsible for this instruction. There is immediate need for a careful study of this problem with a view to its solution.

Women's institutes are just now beginning their development. Institutes for young people can scarcely be said to be started, but are an acknowledged and immediate necessity. Peripatetic work in agriculture along demonstration and advisory lines must be undertaken in the near future and be promoted in a vigorous and extensive way if agriculture is to progress as rapidly as the necessities of the people require. These new lines of effort will not only require a large number of men and women in addition to those now engaged in school, college, and station work to conduct them, but they will demand a different kind of educated man than the institutions responsible for agricultural education have hitherto produced. The future teacher who is to occupy this field must have wide and successful experience in the practical side of the subject that he is to present if he is to be a capable and safe adviser of other men.

To devise a method that will supply such men in large numbers, who will be willing to devote their time to agricultural teaching and the dissemination of agricultural information, is the next great prob-

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lem to be solved. There is needed for its solution a force of experts to give attention to investigation in agricultural economics with a view to increasing the profits of production to the individual farmer as well as for investigating the social conditions of country life with a view to the betterment of rural living. There is also needed a corps of men and women to study broadly the problems of rural education, both as regards the teaching of agriculture to resident students in colleges and schools and the discovery of effective methods for carrying practical information of agricultural character to the great mass of people out of school and for whose education in agriculture adequate provision has not been made. The lack of information in these directions and the entire absence of uniformity in method among educators in carrying on such work or of knowledge of each other's practice are sufficient reasons for the organization of such a force.

Obviously this is a large matter. We have yet to learn how to bring the results of scientific investigation and the best practical experience home to the masses of our rural population so as to materially increase production per acre and make country life more generally satisfactory.

The work of the Office relating to farmers' institutes and kindred organizations has been along practically the same lines as in previous years, the collecting of statistics showing the condition of the farmers' institute movement in this country and abroad; the publishing of reports, circulars, and bulletins of information; lecturing before farmers' organizations and educational associations; and conducting correspondence, especially with state organizations and officers in charge of farmers' institutes and similar work.

Owing to the rapidly growing interest in college extension in agriculture, the duties of the institute specialist, who is acting as secretary of the committee on extension work of the Association of American Agricultural Colleges and Experiment Stations, have been quite considerably increased. Collecting statistical information, visiting educational institutions, and lecturing before extension workers indicate the general character of the work. Similar service has been performed for the American Association of Farmers' Institute Workers, involving, among other things, the editing of the report of the proceedings.

The work of the Office has been materially aided through the assistance of Dr. J. M. Stedman, whose appointment as assistant farmers' institute specialist was made a year ago.

With the broadening of the work of educating the masses of our rural population, the farmers' institutes are no longer the only public agencies for such service, and it is practically impossible to draw any strict line of demarcation between them and the other agencies for what is now generally denominated extension work in agriculture. It is therefore recommended that the language of the appropriation act be changed so as to give definite authority for aiding extension departments as well as farmers' institutes.

PUBLICATIONS OF THE OFFICE.

The growth of the work of the Office during the year has resulted in an increase in amount of published matter. During the fiscal year the Department published 86 documents, aggregating 4,824

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pages, prepared by this Office, not including revised reprints, separates, and minor miscellaneous publications. These documents include 20 numbers of Experiment Station Record, 12 technical bulletins, a report of the Alaska experiment stations, 2 reports of the Office, 17 Farmers' Bulletins (including 5 numbers of Experiment Station Work), 17 circulars, 12 monthly lists of experiment station publications, 2 farmers' institute lectures, and 3 lists of publications of the Office on irrigation, drainage, and agricultural education. Two other numbers of Experiment Station Record, 3 technical bulletins, 1 annual report of the Office, 3 Farmers' Bulletins, 1 article for the Yearbook of the Department, and several miscellaneous documents containing about 1050 pages were prepared and submitted for publication before the close of the fiscal year. Twelve separates of individual articles contained in larger reports, aggregating 436 pages, were reprinted in editions of varying size to supply requests for the articles. Several of the earlier technical and Farmers' Bulletins prepared by the Office were exhausted during the year and were reprinted with additions and corrections.

In addition to the above, 2 reports and 5 bulletins of the Hawaii Station and 2 reports and 3 bulletins of the Porto Rico Station, although printed locally by the stations, were edited in the Office.

The most important increases in the publication work of the Office were in the case of Experiment Station Record and in Farmers' Bulletins contributed by the Office.

In accordance with the plan outlined in the last annual report, Volumes XXI and XXII of Experiment Station Record were issued during the year. Each volume has consisted of six monthly and two additional or, as they are termed, abstract numbers, together with the customary author and subject indexes. The adoption of the plan of having two volumes a year has proved advantageous, as it has made possible the issuing of the indexes more promptly than could be done with but one volume per year, and has also resulted in a less bulky and more convenient volume for binding.

As in previous years, the numbers have been made up largely of abstracts of agricultural literature, together with brief notes on the organization, equipment, and development of institutions for agricultural education and research in this country and abroad, and, in the case of the regular monthly numbers, of editorials and special articles on important phases of the progress of agricultural investigation and science. The abstracts have, as usual, covered the publications of the agricultural experiment stations of the United States and the United States Department of Agriculture, researches of experiment stations and similar institutions in all parts of the world, and a large number of articles having a direct bearing upon agricultural science and practice published in book form or in the domestic and foreign journals.

With the steady development of agricultural agencies the number of articles to be abstracted has continued to increase, but the addition of the abstract numbers has materially relieved the congestion of accumulated material, reduced the interval which must elapse before the publication of abstracts, and to some extent permitted a more complete review of the literature and the preparation of somewhat more extended abstracts. A total of 7,048 abstracts were included

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in the two volumes, by far the largest number in any year, and 1,716 in excess of the number in Volume XX.

As time goes on, the value of the Record as a great repository of information pertaining to agriculture, otherwise available only by an extended examination of the enormous mass of literature which has been published, continues to increase. The 22 volumes thus far issued contain references to no fewer than 78,698 articles, besides editorials, special articles, and notes. The experiment station reports abstracted have alone numbered 914, the station bulletins and circulars 7,401, and the publications of this Department 3,540. The carefully prepared author and subject indexes to the individual volumes and the general index to Volumes I to XII have greatly enhanced the usefulness of the Record. A similar general index for Volumes XIII to XX has been in preparation during the year.

Several changes were made in the staff engaged in the preparation of publications. Dr. L. W. Fetzer, for several years assistant chemist at the Maryland Station, assumed charge of the reviews of agricultural chemistry and technology. Mr. J. O. Rankin and Mr. W. H. Long were also added to the staff, the former in connection with reviewing the literature in field crops and the latter with that in plant pathology and bacteriology.

An increase in Farmers' Bulletins was due to the fact that the various lines of investigation carried on by the Office in nutrition, irrigation, drainage, and agricultural education have now reached a stage justifying wider popular presentation in the form of Farmers' Bulletins.

The Office continued as usual its review of progress in the more practical lines of investigation at the experiment stations in the Experiment Station Work series of Farmers' Bulletins published by the Department at bimonthly intervals.

Two annual reports were issued as in previous years, (1) the administrative report of the Director, giving a summary of the work of the Office during the year, for incorporation in the Annual Reports of the Department, and (2) the larger annual report of the Office specially authorized by Congress and containing the detailed reports of the results of the annual inspection of the work and expenditures of the state agricultural experiment stations, with reviews of progress in agricultural research and education in the United States.

The technical as well as the popular publications based on the work of the Office in nutrition, irrigation, drainage, and agricultural education increased somewhat during the year as a result of a marked development of these lines of work.

As in previous years, the Department published through the Office the proceedings of the Associations of American Agricultural Colleges and Experiment Stations and Farmers' Institute Workers, thus continuing to recognize in this way the close relations which exist between the Office and these associations.

The publication of the card index of experiment station literature was continued as in previous years. Eight hundred cards were submitted for publication during the year. The index is kept as nearly up to date as has been found practicable. Some of the earlier cards, of which the supply had been exhausted, were reprinted in small editions to meet the demand for sets and separate divisions of the

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index. The total number of index cards distributed has now reached 31,000. The receipts from sales of the index during the year were $218.26.

The supervision of the work of preparing the publications of the Office, in case of all publications except the Experiment Station Record, is one of the lines of work of Mr. W. H. Beal. The management of the Record is in direct charge of Dr. E. W. Allen, Assistant Director.

WORK FOR THE CIVIL SERVICE COMMISSION.

The Director of this Office has continued to act as the general representative of the Department in matters relating to the examinations held by the Civil Service Commission for technical and scientific positions in the Department. The number of papers received from the Civil Service Commission recorded in this Office and rated by examiners in the Department during the year was about 2,720, as compared with about 2,000 reported last year. Besides the regular examinations, 38 special examinations were held during the year, as compared with 40 last year.

INSULAR STATIONS.

The past fiscal year has been an interesting and profitable one at each of the stations maintained by this Office. But few changes have been made in the personnel of the stations, and the excellent condition of the work reflects credit upon the special agents in charge.

There has been no change in the policy of conducting investigations looking toward the diversification of agriculture, and the lines of work at the several stations have been continued as before. Much work is done of necessity that appears to be of an elementary nature, and demonstrations are made to give wide publicity to the results of investigations made by the stations, yet the fundamental principles of agriculture are never lost sight of and the scientific aspect of experiments is never disregarded. Each station has its special problems, and the manner in which they are being worked out is briefly described in the subjoined accounts of the work.

The public appreciation of the stations and their work continues to grow, as is shown by the increased demand for station publications and for aid to solve individual problems, by the increased interest in the experiments, and in some instances by individual and local contributions to the expenses of the work. All of this is very gratifying to those in charge, but the appreciation is not wholly confined to the immediate constituency. The published results of the work are repeated in other countries having similar conditions, and some of the work has attracted wide attention. This is especially true of the work with cotton in Hawaii, the studies on manganese in pineapple soils of Hawaii, and those on the "sick" soils of Porto Rico. The work of the Alaska stations is beginning to be recognized, and the mainland press is learning that there are agricultural possibilities of no small importance in that undeveloped country.

The several bureaus and divisions of this Department continue to cooperate generously with the stations, supplying materials and information that are of great value and which the stations can not

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readily obtain for themselves on account of their isolation. It is desired to make proper acknowledgment here for this aid.

The administrative work in connection with the insular stations has increased greatly within the past few years, and the increased purchases made for the stations have required considerable correspondence and attention. As previously mentioned, this work is in charge of Dr. Walter H. Evans. The duties of the accountant of this Office in connection with the fiscal affairs of the temporary disbursing officers have increased steadily with the increase in the appropriations and the expansion of the work at the stations. All accounts of the disbursing officers are subject to a careful preliminary audit before they are approved by this Office. The very satisfactory manner in which these accounts have been handled has received hearty commendation.

As a matter of policy the reports and bulletins of the stations are all referred to this Office before their publication is authorized, and the final preparation of them for printing has taken much time, as it is desired to have them as accurate and concise as possible. Congress at its last session struck out the provision that was held to require the printing in Hawaii and Porto Rico of the reports and bulletins of those stations. It is believed that it will not only be a matter of economy to have them printed here, but they can be gotten out more promptly and in more attractive shape than if printed by the stations.

During the past fiscal year the appropriation for the Alaska, Hawaii, and Porto Rico stations was $28,000 each, and for Guam, $15,000. These sums were supplemented by sales and other funds which were available for maintenance, as follows: Alaska, $1,802.80; Hawaii, $389.29; Porto Rico, $5,814.93; and Guam, $6.

ALASKA STATIONS.

The only changes in the personnel of the Alaska stations during the past fiscal year were the appointment of Mr. A. J. Wilkus to succeed Mr. R. W. De Armond, who resigned after seven years' connection with the Sitka Station, and the resignation of Mr. Herman G. Zoellner, who left the station after a brief stay. Mr. Wilkus is a graduate of the Minnesota Agricultural College, and he had had considerable experience in horticulture with a commercial concern prior to his appointment. At Sitka he will be largely engaged on horticultural investigations.

The plans outlined in former reports have been strictly adhered to, and results from the plant-breeding experiments are beginning to be secured. The main lines of work of the Alaska stations are grain breeding for the development of early maturing varieties; the breeding of horticultural plants, particularly berries and fruits, which are suited to the Alaska climate; cattle and sheep breeding; and the growing of general farm crops with a view to demonstrating whether or not an average farmer who locates in Alaska can make agriculture a success.

Each of the above lines of work is carried on at a separate station. The cereal breeding, testing of varieties of grain, methods of culture, and introduction of new varieties of grains and forage crops are carried on at the Rampart Station, located in the Yukon Valley in

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latitude 65° 30′. It is gratifying to be able to report that success has attended upon the introduction of hardy early maturing varieties of barley, oats, winter wheat, and winter rye. In addition, by cross-fertilization new varieties of barley and oats have been developed, and a number of them are being grown this year for the first time.

The work in horticultural plant breeding is done at the Sitka Station, and the success mentioned in a previous report with hybrid strawberries has been maintained. During the past year nearly 2,000 hybrid plants were under observation, and it is believed that at least a score of them will prove thoroughly adapted to the coast region of Alaska. Most of the hybrid strawberries proved to be shy bearers, but occasional plants were found to be exceedingly prolific, one producing 200 berries. A large proportion of the plants produce berries comparable in size with the average strawberries of the markets, and in addition they partake of the flavor and firmness of the wild berry. A few plants of the hybrid made between the salmon berry and the cultivated raspberry have fruited, but the fruits did not show any improvement over the parental types.

The attempt to secure the hybridization of the native Alaskan crab apple with pollen from early and hardy varieties of apples from the Northern States has been continued, but some years will have to elapse before results can be obtained. As in former years, considerable work is being done in testing bush fruits of various kinds, and these are being propagated and distributed over the Territory for trial as rapidly as possible. Currants, raspberries, and gooseberries have been found to succeed nearly everywhere, but the apple and cherry trees that have been distributed have made but little, if any, growth. It seems almost certain that none of the present varieties of these fruits can mature in Alaska, and the only way to success lies in the development of varieties from hardy wild species.

Some work is being carried on with ornamental plants, and the Tartarian honeysuckle and Japanese rose (*Rosa rugosa*) have been established and are doing remarkably well. In addition to the experiments with fruits, the testing of many varieties of potatoes with a view to selecting those best adapted for general culture is being continued at the Sitka Station.

The cattle and sheep breeding work is all done at the Kodiak Station. The Galloway cattle brought there three years ago are doing well and are proving adapted to the climate and the country. The station suffered no material losses from cattle during the past year, and, although the snowfall was the heaviest on record, the stock kept in excellent condition throughout the winter on native hay and silage put up on the ranch. The object of this experiment is to test the adaptability of these cattle to Alaskan conditions, to develop their milking qualities if possible, in order to make them an all-purpose breed, and to produce surplus stock to be sold to settlers at prices not much in excess of those for which common cattle can be brought into the country. At the end of the fiscal year there were 61 pure-bred Galloways of all ages at the station.

The sheep-breeding work is a new feature, having been introduced during the past year by the purchase of 40 ewes. Most of these sheep have been bred in Alaska and are thoroughly acclimated. The sheep are mostly Cotswold and Merino grades, and it is intended to introduce if possible rams of a large breed, such as the Lincoln. At the

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end of the fiscal year the flock of sheep had been increased to 74 by the birth of lambs.

At the Fairbanks Station the work is chiefly that of maintaining a general farm. Sixty-five acres are under plow and some 40 or 50 acres cleared for meadow. The principal work during the past year was the growing of oats for feed and grain and an experiment in which 11 acres of potatoes were planted to determine the commercial possibilities of producing this crop. The object of the experiments is to determine whether hay and grain can be profitably grown in the interior of Alaska. There are a number of successful market gardeners about Fairbanks, and it is not intended to compete with them by going into general vegetable growing.

A few additions have been made to the buildings of the Alaska stations, the principal being a 100-ton silo and a horse and sheep barn at the Kodiak Station, a combined granary, shop, and implement shed at Rampart, and a combined shop, tool house, and implement shed at Fairbanks.

HAWAII STATION.

No important changes were made in the staff of the Hawaii Station during the past year. A new office and library building was erected from funds generously supplied by the Territory of Hawaii. The new building gives better library facilities than the old one, and in addition contains offices for the special agent in charge, clerical force, entomologist, and agronomist. The old concrete building, with some modification, is now occupied wholly as laboratories for the chemist and horticulturist.

On March 25, 1910, an executive order was issued transferring to this Department the land formerly reserved for the Navy Department but occupied by the station under agreement with the Secretary of the Navy. The cultivated area of the station was increased during the year by the clearing of about 10 acres, most of which have been planted to cotton, bananas, and papayas.

Since the station began the experiments with cotton much interest has been taken in this crop, and about 500 acres have been planted, with every indication of much larger plantings in the near future. The experiments are principally with Sea Island and Caravonica cottons, and as these plants are perennials in Hawaii it is necessary to control their growth to prevent their becoming too large. Experiments have shown that the form of the plant and the time of crop production can largely be controlled by pruning, and that the prunings can be utilized for propagating. Although this method may not prove a commercial success, it has proved valuable in the propagation of pure strains of cotton where the possibility of crossing could not be eliminated. The tendency to heavy production of cotton was shown in a field of Sea Island, where the plants averaged 700 bolls at six months, and some individuals bore as many as 1,200 bolls. This heavy load, especially on the lateral branches, tended to bend the plants to the ground, injuring the lint, and as a consequence experiments are in progress to secure plants with shorter limbs and of a more upright habit of growth. In experiments on the use of fertilizers for cotton, the value of phosphates in increasing production has been clearly shown, increases of two or three fold over check plats being obtained.

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During the year the agronomist visited Japan for the purpose of studying the rice industry and about 150 varieties of Japanese rice were obtained for introduction into Hawaii. Four of these are considered particularly valuable, and it is hoped that from these there may be developed a supply of rice suited to the requirements of the Japanese population of the islands. Extensive fertilizer experiments with rice have been carried on, and it has been demonstrated that the proper time to apply fertilizers for rice is before planting and not with the irrigation water during the growth of the plant, as has been the practice. The rice plant was found to take up its plant food early in its growth and the stooling or tillering was greatly increased by the early application of the fertilizers. It has also been found that ammonium sulphate is a better source of nitrogen for rice in Hawaii than sodium nitrate; in fact, there appears to be some evidence that the rice plant, especially when submerged, does not use the nitrates directly.

Attention is being given to corn breeding, and selection experiments are in progress to obtain the best varieties for Hawaiian conditions.

Through the influence of the station there is considerable interest in the growing of leguminous plants for cover crops and for forage. Pigeon peas, cowpeas, and jack beans are being extensively grown, the pigeon pea and jack bean doing exceedingly well. Cowpeas are subject to attacks of plant lice, but where these pests have been absent the crop has been one of the best. The success attained with leguminous plants has led to the adoption of rotation of crops, especially where pineapples are grown. An experiment with sugar cane has also shown that rotation for this crop is profitable, at least under some conditions.

The station chemist has continued his pineapple investigations, the studies including the effect of manganese on the plant, the process of ripening of the fruit, and the utilization of the by-products from the canneries. The injurious influence of manganese on pineapples has been mentioned in previous reports. Further experiments have shown that where manganese is present in considerable quantity the cultivation of pineapples should be discontinued and less susceptible crops grown in their stead. Where less quantities of manganese are found in the soil the addition of fertilizers composed of superphosphates, sulphate of ammonia, and sulphate of potash will overcome the injurious effect to a considerable extent. These investigations have led to the discovery that the most serious drawback to pineapple culture in Hawaii is a lack of proper aeration of the soil. The soils contain large amounts of iron, and as a result they are easily puddled after a rain or irrigation and air can not penetrate to the roots. Preliminary experiments have shown the value of drainage in increasing the aeration of the soil. A study of the ripening processes of the pineapple has shown that the sugar content of the fruit is directly influenced by the degree of ripeness when cut, there being no increase after the cutting of the fruit, although a green fruit may turn yellow and become soft. The large waste of materials about the pipeapple has led to investigations which have shown methods whereby they can be profitably utilized.

The horticulturist has about perfected methods for the propagation of the mango and avocado, and attempts are being made to secure

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a considerable number of trees of the better varieties. Experiments are also in progress in improving the papaya, and it has been found that by the use of the pistillate plants in an orchard the nonbearing staminate plants can be eliminated. Enough perfect flowers are produced for the purpose of fertilization and the seedlings from such fruits are either all pistillate or perfect, and the results of crossing are eliminated. Marked differences in quality, shipping, etc., have been noted and the experiments are being conducted to improve these characters.

The entomologist has continued his studies of insect pests of agricultural crops with a view to their control. Especial attention has been given the insects attacking sweet potatoes in Hawaii, and a bulletin prepared on the subject. Attempts are being made to introduce parasites of the algaroba bean weevil, but the results thus far can not be safely forecasted. Extensive additions were made to the collections of economic insects, and much work in breeding and life history study is in progress.

The cooperative experiments on the rubber plantations have been continued and the advantages of clean cultivation have been so evident that over 500 acres of planted rubber was given clean cultivation this year. Spraying experiments were tried for the destruction of weeds among the rubber trees, and it was found that the ground could be cleared of all weeds by spraying with arsenite of soda. About 400 acres were successfully cleaned in this way at a cost of about $1.25 per acre.

The station has taken up the problem of establishing demonstration farms in different parts of the islands. The funds are supplied by the territorial government, and it is proposed, as far as possible, to work through the most successful farmer in the different homestead communities. The work will be planned and directed by the station, and the results can be interpreted by the man locally in charge. The work for the present will be largely on better methods of cultivation, rotation, and the introduction of new crops.

PORTO RICO STATION.

The new office and laboratory building provided from insular funds was completed and occupied during the previous fiscal year, but much of the work in connection with the installation of equipment was not finished until 1910. The building has proved a model of comfort and convenience.

The relation of the station and its work to the people of Porto Rico has grown closer with each succeeding year. This is evidenced by the increasing number of visitors seeking information, the growth of the correspondence, and the numerous requests for assistance that involve a personal visit of some member of the station staff.

The work of the station during the past year has resulted in the completion of some investigations that have been in progress for several years and the extension of others. Although some of the work of the station has been conducted with a view to the immediate results of practical importance, yet a strong and persistent effort is being made so to shape the investigations as to determine some of the fundamental principles underlying a rational system of tropical agriculture.

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The chemical department during the past year has carried out a large amount of analytical work on new varieties of sugar cane, waters, limestones, guanos, and other fertilizing materials. The research work has been chiefly devoted to studies on soils and plant nutrition. Among the subjects of soil studies were the formation of calcareous hardpan, injury by alkaline waters, lime requirements of soils, etc. A large amount of work has been done on the causes and means for correction of the chlorosis of pineapples in certain districts of the island, which appears to be due to unfavorable soil conditions. In connection with this investigation a study has been begun on the lime-requiring plants and those which do not thrive in the presence of lime. Some studies on the lime and magnesium ratio for plants have been begun, and a series of water cultures is in progress. The work on the sick soils due to superabundant bacteria described in the previous report has been continued and field experiments on soil disinfection with different chemicals are being carried out. If chemical disinfection proves too expensive it is believed that frequent deep plowing, preferably with a large steam plow, will correct the evil, through the aeration of the soil and the exposure of the organisms to the action of the sun.

The entomologist has continued his studies on the insect pests of citrus trees and has prepared a bulletin describing the principal insects and suggesting means for their control. In the preparation of this bulletin it was necessary to test the methods of combating insects in other regions, and in many instances some modification in the formulas for preparation of the insecticides or their application was necessary to adapt them to Porto Rican conditions. By fumigation, spraying, and the introduction of wind-breaks about the trees, so as to permit the rapid growth of beneficial fungi, it has been found practicable to keep the insects in check on most orchards. An investigation has been begun on the injury to coffee trees by ants. The ants live preferably on the shade trees, but colonies were found on coffee trees, where they do some damage. Experiments with repellants have shown that some may be found effective. An extensive study has been made of *Lachnosterna* sp., an insect resembling the May beetle. Its larvæ are particularly troublesome in cane fields. The beetles feed principally on certain weeds, and spraying the weeds with arsenate of lead was found to destroy the most of the beetles. Carbon bisulphid injected into the soil destroyed the grubs, and experiments are in progress with lime and other fertilizers to prevent, if possible, the depositing of the eggs in the cane.

Through the activities of the station a deep interest has been aroused in bee keeping, and a number of nuclei of broods have been disposed of to go to coffee plantations. At one time the station was instructing 15 persons in the handling of bees, methods of raising, and the production of honey.

The plant pathologist has studied the diseases of a number of economic plants; among them are those occurring on coffee, cacao, pineaples, citrus fruits, sugar cane, and bananas. It has been found possible to control the coffee-leaf blight by spraying just before the beginning of the wet season. Experiments are in progress looking to the control of the coffee disease due to *Stilbum flavidum*. The effect of trenching about trees to prevent the spread of a root disease is being tried. The experiments on soil disinfection for the pre-

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vention of the Fusarium on pineapples have been so successful that the treatment on a field scale was made during the past year. Experiments have shown that spraying with Bordeaux mixture can not be depended upon to control citrus scab in Porto Rico, as is claimed to be the case elsewhere. A study has been begun on the fungi causing root injuries to sugar cane, in which the fungi have been isolated and as far as possible identified.

The work with coffee, in addition to the experiments in the renovation of old plantations and establishment of new ones, includes investigations with foreign coffees, methods of transplanting, viability of coffee seed and means for preserving it, methods of fertilizing and cultivation adapted to different types of soil, etc. Among the foreign coffees introduced by the station a number of trees have borne and the station has limited quantities of seed of Padang, Maragogype, Preanger, a Ceylon hybrid, and the famous Blue Mountain coffee of Jamaica that may be had for planting purposes. These are among the highest priced coffees of the world, and 3-year-old trees have yielded over a pound of cleaned coffee to the tree. In view of the requirements of the appropriation act for this Department the work with coffee will be considerably extended.

Plantings of vanilla, several species of rubber-yielding plants, cacao, and other economic plants have been made, and the station's collections of these plants is being rapidly extended. A study has been begun on the reasons for the rapid deterioration of vegetables grown from northern seed, lettuce, tomatoes, beans, okra, radishes, beets, and cantaloups being experimented with.

The work of improving the live stock of the island is beginning to show some results. The progeny of American saddle-bred horses bred to native mares have matured into handsome animals that command very high prices. The station has introduced six more horses during the year to continue the work. The cross-bred zebu bulls introduced by the station in 1909 have developed splendidly and they will be used to improve the size of the native cattle. The woolless sheep introduced from Barbados a year ago have proved well adapted to their surroundings, but need some improvement in their meat-yielding qualities. The breeds of pigs and poultry introduced by the station are proving adapted to Porto Rican conditions and the surplus is in great demand by planters and breeders. Continued experiments with cane tops and corn as silage have shown the importance of the silo as an adjunct to stock keeping.

During the year more sanitary and commodious buildings for the farm live stock have been erected.

GUAM STATION.

The purchase of the tract of land leased by the station from Juan Torres has been completed and the transfer of the property made according to the laws and customs of Guam. The purchase price, $1,300, is considered very reasonable and the station now has a permanent location. The land has been cleared of its tropical growth and fenced, some roads have been constructed, and necessary buildings have been erected or are in the course of erection. Of the 32 acres that are adapted to general agriculture all but 5 or 6 are now under cultivation. In order to supply the station with water for

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irrigation and other purposes a well has been dug that gives an abundance of good water, and an engine, pump, and pipes have been secured to convey the water to points where it is needed.

The work of improving the station has proceeded exceedingly well, when one considers that nearly all supplies must be sent by transport from San Francisco and all the planning and much of the oversight of the work devolve directly on the special agent in charge. A capable foreman has been secured and the burden somewhat lightened.

The greater portion of the available land has been planted to forage crops of various kinds. One of the lines of work which it is desired to take up is the introduction of better live stock, but before that can be done a regular supply of forage must be assured. On this account especial efforts are being given to the production of forage, and Kafir corn, Egyptian corn, broom corn, sorghum, milo maize, Johnson grass, Guinea grass, *Paspalum dilatatum*, peanuts, mung beans, jack beans, cowpeas, soy beans, and velvet beans have all been introduced and are under comparison. Kafir corn has produced large yields of green feed when planted during the dry season, and when cut the plants send out new shoots and quickly produce a second crop. The ratooning habit has been found to apply to a number of crops in Guam that are ordinarily grown as annuals elsewhere. Among the grasses, *Paspalum dilatatum*, a native of Brazil that has become established quite extensively elsewhere, gives promise of the greatest value. Guinea grass that was introduced from Hawaii is also promising and it is believed that under more favorable circumstances it will yield heavily. Johnson grass, which was introduced into Guam some years ago under the name Samoa grass, was planted at the station, but it has thus far shown no superiority over the two other species mentioned. On account of its tendency to spread and to hold the ground, even against cultivation, it will not be distributed for general planting until its habits in Guam are better known.

The experiments with leguminous plants are proving quite successful, so far as growing the plants is concerned. Cowpeas and velvet beans grow readily and yield a large amount of forage, but where it is desired to enrich the soil by plowing them under, the native plows will not answer the purpose. A variety of bush Lima beans has been secured that produces an immense amount of leaves on fairly good soil and that are more easily plowed under. The soil of the station, although formerly in cultivation, has, through the common methods of cultivation, been depleted of much of its fertility. It is, however, typical of much of the farm land of Guam and offers a good opportunity of demonstrating methods of enriching the soil through the use of leguminous crops, etc.

Some attention is being given to corn culture and methods for improving it. Considerable corn is grown in Guam and it forms a staple article of diet, being largely used in the form of corn cakes. The special agent in charge has introduced a small hand mill for grinding corn to take the place of the usual laborious method, and he is experimenting with the ground seed of Kafir corn as a substitute for maize meal. An experiment is in progress to determine a practicable method of storing corn and other grains. Great losses are occasioned by weevils and rots due to the excessive humidity, and as

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a result only limited quantities are commonly stored. A method of kiln drying and sealing in tanks is being tried as a means of preventing loss and providing a supply for future use.

A number of the fruits and vegetables introduced by the station are giving excellent results. Pineapples and avocados introduced through the Hawaii Experiment Station are thriving, the first avocados produced on the island being from seed sent to Guam from Honolulu for planting in the governor's garden some four or five years ago. Several varieties of sweet potatoes were introduced from Hawaii and they have proved superior to anything previously grown in Guam. Experiments are in progress with a large number of other field crops and vegetables, and with some considerable success has been attained.

The station is striving to gain the confidence and interest of the people in its work, and for the short time it has been in operation the condition seems quite satisfactory. The people seem anxious to obtain seeds of plants the value of which they can see, and some are quite interested in the implements and methods of cultivation that have been adopted. One of the most successful implements is a small cultivator that costs about $5. With one of these and a carabao a man can do more and better work in the field than 10 men can do with the native implements. The advantages of this cultivator have been quickly perceived, and arrangements have been made to supply a limited number of requests for them at cost until dealers have them for sale. The introduction of these will doubtless be followed by a demand for other agricultural implements and tools and a decided advance in agriculture will be brought about.

The introduction of some improved live stock and the study of some of the more important insect pests and plant diseases are problems that are to be taken up as soon as possible. For the present the important problem is to interest the people in agriculture and get them back upon the farms. It is believed this can best be accomplished by simple experiments in which the elementary principles of agriculture are taught through ocular demonstration.

IRRIGATION INVESTIGATIONS.

Prof. Samuel Fortier continues to have charge of the Irrigation Investigations of this Office.

The rapid extension of the area under ditch and ready for settlement during the last few years and the large amount of advertising done by promoters of irrigation enterprises have created a heavy demand on this Office from possible settlers for information of two general classes: (1) General information regarding conditions in the arid region—climate, water supply, crops grown, cost of water, cost of land, and cost of establishing farms under irrigation; and (2) practical information regarding methods of securing water supplies, of preparing land for irrigation, and applying water to crops. It is believed that in supplying this information this Office can be of greater service to both the intending settlers and the communities to which they expect to go than in any other way. Consequently the preparation of bulletins containing this information was made the leading feature of the work during the last fiscal year.

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Arrangements were made for the preparation of a report on irrigation conditions in each of the arid States and Territories, most of these being prepared by the state or territorial engineers of the respective Commonwealths, and where this Office does not exist other local parties familiar with the water resources and agricultural conditions were employed to prepare the reports. Seven of these reports were published during the preceding year, four were published during the year just closed, and the others are either in hand ready for publication or are in preparation. The demand for these bulletins has been so great as to amply justify their publication. Parties interested naturally turn to this Department for reliable information regarding conditions in the sections advertised, and the bulletins included in this series should be of great service in the settlement of the lands being reclaimed, by calling attention to the opportunities afforded by these lands and at the same time informing intending settlers as to the conditions which they will find and the expenses which it will be necessary to incur.

The settlers for the lands being brought under ditch must come principally from sections where irrigation is not practiced. They need not only the information regarding climate, crops, and general conditions contained in the bulletins just mentioned, but even more they need practical directions as to how to perform those operations connected with crop growing in the new sections which are peculiar to irrigated land. Most of these settlers are from agricultural sections, and are therefore familiar with growing the standard farm crops, but they are ignorant of the use of water in irrigation. For this reason a series of bulletins covering the irigation of the standard crops is being prepared. During the summers of 1908 and 1909 the regular field force of this Office and a number of special agents were engaged in collecting information as to the best practice in all the irrigated sections of the West. Bulletins on the irrigation of alfalfa, sugar beets, grain, and orchards have been prepared and published as Farmers' Bulletins. These bulletins deal in a practical way with preparing land for irrigation by various methods, the building of farm ditches and structures for distributing water to the fields, and applying water to the land, and with other operations connected with the use of water for irrigation. The establishment of a home on new lands is always a difficult undertaking, in which many fail, but it is doubly so when there is added to the usual labor and expense the burden of leveling land, building ditches, and applying water, with all of which the settler is unfamiliar. Settlers must learn much by experience, but plain descriptions and directions, such as are contained in these bulletins, will increase very greatly the chances for success on the part of these settlers. There has been a large call for these bulletins, both from settlers and from the builders of irrigation works, who recognize that they can succeed only through the success of the water users.

The men of the field force of the Office devote as much of their time as possible to aiding settlers by personal advice and by delivering addresses, but the efficiency of the work would be greatly increased by the establishment of demonstration farms on which all the standard methods of preparing land and controlling and distributing water should be illustrated. The one feature new to settlers

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in the arid region is the use of water, and the primary purpose of all demonstration work in this region should be showing the settler how to use water. Some of the state experiment stations have established substations in newly irrigated sections for the purpose of experiment and demonstration, and this Office is cooperating in the operation of these stations, notably in California, Washington, Utah, and Idaho. This work might be extended to advantage, making the main feature at each farm the illustration of methods of using water.

While the most pressing agricultural need of the arid region just now is for practical directions regarding the use of water for the incoming settler, ultimately the greatest need will be a more economical use of the limited water supply. For this reason much attention is being given to the study of methods of preventing the enormous losses of water which previous investigations have shown to exist. These measurements have shown that water is lost by percolation and evaporation from the point of its diversion into canals until its final dissipation after being applied to fields, the total of these losses equaling from one-half to three-fourths of the quantities diverted. The checking of these losses offers the greatest opportunity for the future extension of the irrigated area in the United States, since the total water supply will reclaim only a small part of the available land of the arid region.

The greatest losses arise from seepage from earthen canals, and this Office is carrying on experiments to determine the cost and effectiveness of different canal linings and methods of treating the bottoms and sides of canals to lessen seepage.

It is possible to prevent seepage by lining canals with cement, plaster, or concrete, but the cost is often too great for the crops grown in many sections, and the real problem is to check the losses at a cost which can be repaid from the crops grown. Every saving effected is equivalent to a new supply of an equal volume, with the added advantage that the water saved would not only have been lost, but would have injured the lands into which it seeped.

Further losses occur when the water is applied to the soil, due to evaporation into the air and percolation into the subsoil beyond the reach of plant roots. That these losses are large and that they are checked by applying water in such a way that the top soil is not saturated and by cultivation after irrigation has been a matter of common knowledge for many years, but there has been no exact knowledge as to the extent of the losses or the effectiveness of the means adopted to check them. Experiments to determine these questions were begun by this Office, in cooperation with the State of California, in 1905, and have been continued since that time. The results from these experiments were so good that it seemed best to extend the experiments to other places with different soil and climatic conditions, and consequently, in the season of 1908, the necessary equipment was installed at Reno, Nev.; Bozeman, Mont.; Agricultural College, N. Mex.; and Kennewick, Wash.; and in the spring of 1909 at Williston, N. Dak., and Caldwell, Idaho. Similar experiments in applying water by different methods and following irrigation by different degrees of cultivation were carried on simultaneously at these points during the season of 1909, and are being continued in 1910. The principal value of these experiments will be in giving exact knowl-

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edge of the magnitude of the losses from evaporation and a quantitative measure of the effectiveness of different methods of applying water and of subsequent cultivation. The possession of this knowledge will do much toward preventing the losses.

Studies of the use of power for irrigation were continued during the year, special attention being given to the possibilities of the use of windmills for irrigation in the semiarid States. This work consisted of mechanical tests of several mills at Cheyenne, Wyo., in which accurate records of the work done in various wind velocities and of the labor and expense necessary for maintenance and repairs were kept, and in the collection of data as to the work being done by mills in use for pumping water for irrigation on the Great Plains. Technical and popular reports of these investigations have been prepared, a popular bulletin on the use of windmills having been published as a Farmers' Bulletin. Studies of pumping in California and in the rice districts of Louisiana and Texas have been continued.

The investigation of irrigation practice in the rice districts of Louisiana and Arkansas carried on for several years was continued during the year, a popular bulletin on small pumping plants having been published and a report dealing with irrigation practice in rice growing designed especially for beginners in this industry has been prepared. These studies of irrigation of rice are being continued during the present year.

The principal field for the irrigation work of this Office is in the region where irrigation is necessary to the carrying on of agricultural operations. There are also large sections where farming can be carried on without irrigation, but where irrigation may prove to be of great value as an aid to a higher class of farming and as an insurance against drought. This is especially true of the Great Plains, which have been settled very rapidly during the last few years. In the belief that the irrigation of a small area in connection with the farming of a larger area without irrigation will do much toward making the recent development permanent and profitable, this Office has for several years maintained farms at Cheyenne, Wyo., Eads, Colo., and Newcastle, Wyo., where the problems of this type of irrigation are being worked out and the irrigation methods adapted to that region are being demonstrated. It is planned to continue these farms for a few years more at least. Progress reports of the work at Cheyenne and Newcastle have been published during the last year.

The problems connected with irrigation as a supplement to farming without it were studied in the Willamette Valley, Oregon. Experiments were carried on in cooperation with local farmers to determine both the advantages to be derived from irrigating during the dry summer months and the methods best adapted to local conditions. A report giving the results of these experiments has been published.

Even in the humid regions the practice of irrigation is extending rapidly in the growing of high-priced fruit and truck crops. In the season of 1908 this field was deemed of sufficient importance to justify the assignment of a man to it, and the work has been continued since that time. The methods in use are expensive and in many cases not well adapted to conditions, and our agent, who is familiar with western methods, has been of great service to those undertaking irrigation in the East. This work will expand rapidly and will demand more attention in the future.

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WORK IN FISCAL YEAR 1911.

It is proposed to continue the work along the same general lines as were followed in 1910. Additional bulletins of the series on irrigation in the several arid States and Territories will be published and also additional bulletins of the practical series dealing with the irrigation of the standard crops of the arid region. In connection with the collection of information for these bulletins, views showing the various operations connected with applying water to crops and the implements used are being secured and lantern slides are being made from these for use in popular lectures on methods of irrigating to be delivered by members of the force during the winter in the sections where settlement is most rapid and the need for the spread of such information is greatest. It is believed that this will be a very valuable supplement to the practical bulletins along these lines, and will do much to promote better methods and help the settlers to do their work to best advantage.

The experiments in ditch linings for checking seepage losses will be continued at Davis, Cal., while the tank experiments to determine evaporation losses and the effectiveness of methods of checking these losses, carried on at various points, will be continued. Field experiments to determine the quantities of water required for irrigation will be continued. As the demand for assistance to settlers decreases more attention will be given to scientific studies which have for their purpose a more exact knowledge of the quantities of water required for crop production, the best methods of applying water to secure its proper distribution in the soil and to prevent its loss by evaporation or percolation.

In the investigations of the use of power for irrigation the work will be about equally divided between advising parties who are installing pumping plants and the studies necessary for the preparation of a practical bulletin on engine pumping plants, to follow the bulletin of the same character on windmill pumping plants published in 1910.

The farms in the semiarid region will be operated during this season and should be continued during 1912, while the work of similar character on the Pacific slope should also continue.

In the humid region cooperative experiments with several farmers in the Gulf States have been arranged, in which these farmers are doing the work under the direction of the agent in charge. In the trucking districts of Florida more such experiments are being carried on.

WORK IN 1912.

The investigation of questions pertaining to irrigation which is now being done should be not only continued, but extended in 1912. The demand for practical information from settlers on lands provided with water rights is quite certain to continue and perhaps increase, and so long as this is the case the right kind of information should be supplied to the settlers through the medium of bulletins, lectures, personal advice, and demonstration farms. The continuation and enlargement of this practical work should not be allowed to encroach upon other lines of even greater importance, such as the proper use of water, the prevention of waste, and the collection of

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scientific data pertaining to irrigated farming. In like manner the increasing demand for reliable information on the part of the fruit and truck growers of the humid region who have either installed or contemplate installing irrigation plants should not be allowed to withdraw much-needed funds from the arid region. The plan of placing an expert permanently in charge of the work in each western State, adopted a few years ago but not extended to all the arid States for lack of funds, has proven a most efficient means of carrying on these investigations. It would now seem advisable to establish an agency of this kind in each western State, as well as a limited number in the irrigated rice fields of the Gulf States and in the fruit and truck districts of the Atlantic seaboard and the Mississippi Valley. This will require an additional appropriation for the fiscal year 1912.

DRAINAGE INVESTIGATIONS.

Mr. C. G. Elliott continues to have charge of the Drainage Investigations of this Office.

During the past year the unfinished drainage projects of the year previous have been completed and many new projects and investigations taken up. A summary of the work done embraces surveys, working plans and profiles, and reports made for these various drainage districts, which may be classed as follows:

DRAINAGE SURVEYS.

I. *Reclamation of lands subject to overflow, as by floods.*—Arkansas: St. Francis Basin, Black River Levee. Iowa: Big Sioux River, Des Moines River. Kansas: Cottonwood River, Kansas River, Little Caney River, Marais des Cygnes. Mississippi: Tuscumbia River (Alcorn and Prentiss counties). Missouri: Grand River, vicinity of Pattonsburg (Daviess County). Nebraska: Salt Creek, Wahoo Creek, Nemaha River. North Carolina: Pungo River, Pantego Creek, Broad Creek, Lower Creek (Burke and Caldwell counties). Oklahoma: Deep Fork of Canadian River (Lincoln and Okmulgee counties). Texas: Chambers Creek (Ellis County Drainage District No. 1).

II. *Reclamation of lands continually wet—swamps, marshes, etc.*—North Carolina: Lyon Swamp and Cape Fear River, Lake Phelps, lands lying between Albemarle and Pamlico sounds (Beaufort, Washington, and Hyde counties), Orton Plantation (Brunswick County), Smith Plantation (New Hanover County). Virginia: Berkeley Swamp.

III. *Improvement of natural water courses or construction of new channels to provide outlets.*—Arkansas: Cury Bayou. Kentucky: Canoe Creek (Sellars Ditch). North Carolina: Belvidere Swamp. South Carolina: Hopkins District.

IV. *Farm drainage.*—Arkansas: State Normal School Farm (Conway). Delaware: Redden Farm (Sussex County). Indiana: Jaqua Farms (2) (Jay County). Iowa: Huston Farm (Lee County). Kentucky: Marrs Farm (Henderson County), Rankin Farm (Henderson County). Louisiana: Knox Plantation (East Baton Rouge Parish). Maryland: Marine Corps Rifle Range (Charles County), Sewall Tract (Montgomery County), Baltimore County High School Tract,

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Princess Anne Academy Tract (Somerset County). Virginia: Bechtel Farm (York County), Cumberland Farm (Norfolk County), Virginia Truck Experiment Station Farm (Princess Anne County), Cuthbert Land and Development Company (Fairfax County). Vermont: Morgan Horse Farm (Addison County).

V. *Drainage of irrigated lands.*—California: Fresno. Colorado: San Luis Valley, Grand River Valley. New Mexico: Pecos Valley. Texas: Lower Rio Grande Delta, Val Verde Irrigation Company's Tract (Val Verde County). Utah: Various tracts in several counties. Washington: Yakima Valley, including the Moxee Valley. Wyoming: Laramie (State Experiment Farm), Big Horn Basin, including Grey Bull Valley, Shoshone Valley.

PRELIMINARY EXAMINATIONS AND CONSTRUCTION WORK.

In addition to preliminary examinations having been made and reports written for all the projects enumerated under drainage surveys, similar examinations and reports have also been made for the following:

Alabama: Big Spring Branch (Madison County). Arkansas: Cypress Drainage District (Chicot and Desha counties). White River (White County), Throgmorton Tract (Randolph County). Georgia: Glynn, Bryan, Clinch, Echols, Liberty, and McIntosh counties. Illinois: Cache River Drainage District. Iowa: Monona, Harrison, Woodbury, and Pottawattamie counties. Kansas: Verdigris and Fall rivers. Louisiana: Fifth Louisiana Levee District. Mississippi: Black Creek (Holmes County). Nebraska: Upper Elkhorn Valley (Holt County), Red and Sulphur rivers. North Carolina: Haw River (Rockingham County), Little Creek (Orange and Chatham counties), Salem Creek (Forsyth County), swamp lands in Robeson County, Turnbull Swamp, various streams in Iredell, Rowan, and Cabarrus counties. Oklahoma: Washita River (Washington County), Black Bear Creek (Noble and Pawnee counties). Tennessee: North and Middle Forks of Forked Deer River (Gibson County). Texas: Elm Fork of Trinity River.

The following projects for which this Office has made surveys and prepared plans are now under construction by landowners:

Louisiana: Willow Bayou. Mississippi: Boggy Bayou Drainage District, Bogue Hasty Drainage District (Bolivar County). North Carolina: Lower Creek Drainage District (Caldwell and Burke counties), Moyock Drainage District No. 1. Virginia: Cumberland Farm (Norfolk County).

GENERAL TECHNICAL INVESTIGATIONS.

Special investigations have been carried on to determine: The run-off from various Louisiana lands where pumps are required to remove the water; the proper method of draining irrigated lands affected by alkali or seepage, or both; the effect of alkali solutions on cement; the best methods of draining alkali lands in the Rio Grande Valley, Texas; the best methods of draining salt-marsh lands of the Atlantic coast; the water content of muck and peat soils in Louisiana and Florida.

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DISSEMINATION OF INFORMATION.

The Washington office has carried on extensive correspondence of an advisory nature in response to inquiries relating to drainage problems throughout the United States, and through its corps of engineers has rendered assistance by personal consultation with individuals and officials of drainage districts. As samples of this class of work, may be mentioned the following:

Illinois: Cache River Drainage District. Missouri: Kincaid Farm (St. Charles County). Nebraska: Jackson Ditch (Dakota County), Elkhorn Valley Drainage District. Oklahoma: North Canadian River (Oklahoma County).

Public drainage meetings were addressed by different members of the staff in Arkansas, California, Colorado, Georgia, Iowa, Kansas, Louisiana, Mississippi, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Utah, Washington, and Wyoming.

WORK PLANNED FOR THE FISCAL YEAR ENDING JUNE 30, 1911.

The requests for drainage surveys, plans, and reports have become so numerous that it is possible for the Office to grant but comparatively few of them, and the effort is being made to make the preliminary examinations of projects complete enough, so that, where possible, definite recommendations may be made as to the proper methods of reclamation, in order that the local drainage districts may carry out the drainage survey themselves. As will be noted from the preceding summary of the work, three new fields of investigation have been opened up in New Mexico, Washington, and Wyoming, as the seeped and alkalied conditions had become so aggravated in these localities that assistance was badly needed. The work in Utah will continue and will be cooperative to a certain extent, the State sharing a portion of the expense. On account of the urgent need of assistance in the Lower Rio Grande Delta, Texas, it is probable that an engineer may be sent to that field during the coming winter. Drainage surveys will be conducted in the South during the severe season of the year, and the attempt will also be made to take up projects in the States where there is urgent need for them and where the Office has not as yet operated. The subject of drainage by pumping will be investigated. Run-off investigations will also be continued in Louisiana and elsewhere, and the determination of the water content of muck and peat soils will be taken up in Wisconsin and other States in continuation of the work already done on such soils in Louisiana and Florida. As forecasted in the report of 1909, the scope of the advisory work in assisting districts as to proper drainage methods will be enlarged.

WORK PROPOSED FOR THE FISCAL YEAR ENDING JUNE 30, 1912.

The increasingly widespread interest being manifested in drainage matters will make more frequent the calls upon this Office for assistance, and on account of the information and experience already gained it will be possible to make the work more and more effective.

There is an increasing demand for examinations of swamp lands with reference to their value for agriculture and information con-

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cerning methods of draining them. The Department has not been able to comply with many requests for such service because of the demand for examinations, reports, and plans needed for the drainage of special fields and areas in various parts of the country. Such examinations are needed for the intelligent initiation of land-drainage projects.

The area of irrigated lands which need draining is increasing in a certain ratio as new irrigation projects are developed. Newly reclaimed arid lands are being put under cultivation and farmers require practical assistance on the ground whenever the need of draining such lands appears. It is certain that greater demands will be made upon the Department for assistance of this kind. The area of unreclaimed swamp land is so large that we can not expect that there will be any material diminution in the demands of those who are engaged in agriculture for services of this kind. It is believed that by demanding of landowners a part of the expense of making investigations and surveys with reference to reclamation by drainage, an appropriation of $85,000 for the year 1912 will be sufficient to meet reasonable demands.

NUTRITION INVESTIGATIONS.

The general purpose of the Nutrition Investigations is to study various aspects of the problem of the value for human food of agricultural products, both animal and vegetable, and during the year ending June 30, 1910, attention has been given especially to matters which have to do with meat and cheese. The respiration calorimeter, which has been installed in improved form at the Department of Agriculture and which has been carefully tested and found fully satisfactory, was used in the work. This apparatus, it is believed, offers a new and valuable method for studying many problems with which the Department of Agriculture is concerned. Work will be carried on in cooperation with other bureaus whenever such an arrangement will further the interests of the Department and insure economy of effort.

The problems studied with the respiration calorimeter during the last fiscal year have had to do particularly with the relative ease of digestion of cheese and meat as part of a simple mixed diet. The results as yet obtained do not show that significant differences exist when the quantities eaten are comparable with those observed in the usual diet. This work was undertaken to round out investigations carried on in cooperation with the Bureau of Animal Industry.

In addition to the more technical work, many tests have been made of methods of preparing meat and cheese for the table. The data thus obtained with meat, together with the results of the more technical studies, have been embodied in a Farmers' Bulletin on the economical use of meat in the home, and it is proposed during the coming year to prepare a similar publication dealing with the use of cheese as an economical and nutritious part of the diet.

During the fiscal year 1911 it is proposed to study the question of the relative value of lard, butter, vegetable oils, cream, and other culinary fats, particularly with reference to their ease and thoroughness of digestion. Such data are needed for the satisfactory discus-

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sion of household problems, as well as for use in connection with other work in which the Department is interested.

Many important matters concerned with the economical use of cereals, fruits, and vegetables, and products made from them, can be studied by use of the apparatus and methods now available, and it is believed that such studies as well as those already in hand can not fail to yield results of importance in discussing available food supply with reference to economical and rational living.

The relation between food consumption and the production of useful work on the farm and in the home is a question of importance that can be studied with the respiration calorimeter, as readily and as satisfactorily as the relation of fuel to the production of work in an engine can be studied by the ordinary laboratory methods at the disposal of the investigator.

The respiration calorimeter affords an opportunity for studying such problems as those mentioned as well as many others under very favorable conditions, since it permits of the rapid and accurate measurement of a large number of factors which are of the greatest importance in drawing trustworthy deductions.

During the year three technical bulletins and two Farmers' Bulletins have been issued and several other technical and popular bulletins are in the printer's hands, or await publication. Summaries have been prepared for publication in annual reports and a series of fifteen colored charts, designed to show in graphic form the nutritive value of foods, have also been published. Abstracts of articles on nutrition have been prepared, as heretofore, for publication in the Experiment Station Record and popular summaries of data, particularly in respect to the nutrition work of the experiment station, have been prepared for publication in the series of Farmers' Bulletins entitled "Experiment Station Work." The correspondence and other general work necessitated by the nutrition investigations has been carried on as usual and the marked growth in work of this character and increased number of requests for information and for nutrition publications, particularly with reference to the economical preparation of foods in the home, is an indication of a widespread and general interest in nutrition work on the part of home makers on farms and in towns, as well as of students, teachers, physicians, and investigators.

A large part of the work of diffusing the information acquired in the nutrition investigations is most effectively done through colleges, schools, farmers' institutes, extension departments, and women's organizations of various kinds. The agricultural colleges and schools, state departments of agriculture, granges, and other agricultural organizations are rapidly extending their operations relating to the work of women on our farms. This Office is seeking active cooperation with these educational agencies as one of the best means of securing the rapid spread of rational ideas regarding human food and nutrition.

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REPORT OF THE DIRECTOR OF THE OFFICE OF PUBLIC ROADS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF PUBLIC ROADS,
Washington, D. C., November 15, 1910.

SIR: I have the honor to submit herewith the report of the Office of Public Roads for the fiscal year ended June 30, 1910, and also an outline of the work planned for the current and ensuing years.

Respectfully,

LOGAN WALLER PAGE, *Director.*

Hon. JAMES WILSON,
Secretary of Agriculture.

WORK OF THE YEAR.

The work of the past fiscal year comprised cooperation with local authorities in the construction of object-lesson roads for the purpose of introducing standard forms of construction and instructing local road builders; the construction of experimental roads and the conducting of laboratory investigations for the purpose of testing various bituminous and other road binders, and for developing and improving methods of preparing and applying them; laboratory and field experiments in the utilization of by-products, particularly slag, for the construction of roads and the treatment of old roads; field experiments in sand-clay construction and variations of the sand-clay method, with a view to adapting it to the various climatic, soil, topographic, and traffic conditions; a series of economic investigations to determine the effect of good and bad roads upon the welfare of the rural population; the introduction of the split-log drag and the distribution of information concerning its construction and use; the inspection of roads on which rural delivery routes are established, and the giving of advice concerning their improvement with the means already available; traction tests, conducted to determine the relative tractive resistance offered by roads of various types and at various grades, with the use of both narrow and wide tires in the experiments; the routine testing and analyses of road materials to determine their physical qualities and mineral composition; the training of engineer students in highway engineering, both practical and theoretical; the collection of accurate and comprehensive data relating to road mileage and the progress of road improvement in the United States to the close of the calendar year 1909; practical lectures and addresses delivered throughout the United States; the giving of advice and instruction concerning specific problems in road work; cooperation with States and counties in bringing about a general improvement in administrative systems, and in methods of construction and maintenance, notable examples of which were cooperation with the State of Louisiana in the organization and operation of convict camps for

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the construction of roads, the training of graduate engineers from the state university and the preparation of a suitable road law for the State, and cooperation with the counties of Lamar, Tex., and Kalamazoo, Mich., in the establishment of model systems for county-road work; the preparation of various publications issued as Farmers' Bulletins, Office bulletins, and circulars; the establishment of a section of the Office for the purpose of giving expert advice and information concerning bridge designs for rural traffic; and the making of surveys, plans, and estimates. In addition to the foregoing regular projects, the Office has continued its investigation concerning the corrosion of iron and steel, and has taken up an important new project dealing with the use of oil in concrete work.

An elaborate and thoroughly successful exhibit was installed at the Alaska-Yukon-Pacific Exposition at Seattle, and the same exhibit was afterwards taken to Omaha, Nebr., to the Corn Show and Omaha Exposition. From that point it was shipped to Washington, D. C., where the models were on exhibition at the Builders' Exchange Exhibit Company; later, the exhibit was installed at the Appalachian Exposition, Knoxville, Tenn.

The appropriation for the past fiscal year was $116,460, an increase of $29,070 over the appropriation for the fiscal year 1909, or about 26 per cent. There were on the rolls of the Office June 30, 1909, 63 permanent employees. During the fiscal year 1910, 37 new employees were appointed, while there was a loss of 9 by transfer and resignation, so that the net increase for the fiscal year 1910 was 28. The total number of employees on the rolls on June 30, 1910, was 91. In addition to these, 28 temporary employees were appointed during the fiscal year 1910. It will thus be seen that the increase in force more than corresponded to the increase in appropriation.

On June 11, 1910, the Office vacated the building at 237 Fourteenth street SW., and moved into the building at Fourteenth and B streets SW., which had formerly been occupied by the Bureau of Chemistry, and which was thoroughly remodeled to suit the needs of this Office. The present quarters are excellent in every respect, and it is believed that the facilities for chemical and physical investigations of road materials and for correlating all branches of the office work are unsurpassed by any institution or organization of a similar kind in the world.

In summarizing the amount of work accomplished under the various projects, attention should be called to the fact that 48 object-lesson roads were completed during the past fiscal year, as compared with 57 for the previous year, and that the total yardage was 1,002,751, as compared with 690,059 yards for the previous year.

In the field experimental work commendable progress was made. To indicate the comprehensive character of the field investigations, it may be stated that the experiments consisted of building 8 experimental roads of blast-furnace and open-hearth slag, 3 of concrete, 1 of brick, and 10 of bituminous macadam, using a variety of bituminous materials.

In the educational work, through the medium of lectures, 33 States were reached, and a total of 523 lectures given as compared with 185 for the previous year.

With regard to the special advice given concerning road problems the Office increased its field of usefulness very materially, since the number of such assignments was 243 as compared with 142 for the

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previous year. In addition to these, 5 special surveys and 4 bridge inspections, involving the preparation of plans and estimates, were made.

In the routine testing of road materials in the laboratories a notable gain was shown as compared with any previous year. The total number of such tests was 1,168 as compared with 735 for the fiscal year 1909, which in turn was the largest for any one year since the establishment of the Office.

The laboratory investigation and testing of bituminous binders has grown to be a very important and extensive section of the laboratory work. Suitable facilities were not provided, however, for these investigations until near the close of the fiscal year.

The collection of data relating to road mileage begun in December, 1909, was about one-half completed at the close of the fiscal year.

On the whole, it may be conservatively stated that the work of the fiscal year 1910 exceeded the work of the best previous year in amount by at least 50 per cent. The personnel is better organized and more familiar with the duties required of it; the methods for conducting work have become more nearly standardized; and a better system prevails along all lines. In the efficiency of work done the Office has certainly made a gain commensurate with the increase in the amount of work.

The detailed reports of the work performed under each project are given in this report as follows.

OBJECT-LESSON AND EXPERIMENTAL ROADS.

Object-lesson roads are constructed for the purpose of giving practical instruction to local road builders of the methods of road building. The Office furnishes, at government expense, one or more engineers, who make the necessary surveys, estimates, and specifications, supervise construction, and give theoretical instruction, while the local authorities furnish all machinery, materials, and labor. During the past year 6 roads which had been begun in the last fiscal year were completed, 49 were begun and completed during the year, and 2 were unfinished on June 30, 1910, and will be reported in the next annual report. Classed according to materials of construction these roads were as follows: 3 bituminous macadam, 1 oil-gravel, 6 macadam, 6 gravel, 27 sand-clay, 10 earth, 1 concrete, 1 slag, and 1 brick. For the purpose of comparison the following table is given, showing the number of square yards of each type of road constructed during the fiscal years 1905, 1906, 1907, 1908, 1909, and 1910:

Object-lesson roads constructed during 1905, 1906, 1907, 1908, 1909, and 1910.

Material.	1905.	1906.	1907.	1908.	1909.	1910.
	Sq. yds.	*Sq. yds.*	*Sq. yds.*	*Sq. yds.*	*Sq. yds.*	*Sq. yds.*
Macadam	44,944	51,246	76,376	72,587	96,107	50,333
Gravel	8,804	4,197	11,722	4,608	65,793	71,376
Shell	5,877	933	.....	14,020	1,630	.....
Earth	.....	12,132	27,042	85,967	319,456	651,109
Sand-clay	19,178	19,443	85,571	42,634	205,032	177,960
Burnt clay	400	.....	.....	3,392	2,041	.....
Bituminous macadam	.....	.....	.....	.....	.....	45,832
Oil-gravel	.....	.....	.....	.....	.....	4,819
Concrete	.....	.....	.....	.....	.....	1,004
Slag	.....	.....	.....	.....	.....	4,610
Brick	.....	.....	.....	.....	.....	526
Total	79,203	87,951	200,711	223,208	690,059	1,007,569

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Experience has shown that earth roads can be greatly improved by proper construction and systematic maintenance at a cost well within the reach of practically every community and, since 90 to 95 per cent of the total mileage of roads must remain earth roads for years to come, the Office is encouraging the improvement of this type of highways. In the past water-bonded macadam has been used extensively for surfacing earth roads, but, when subjected to heavy automobile traffic, this surface rapidly disintegrates. Fairly successful efforts have been made to find a means of preserving the roads already surfaced and to develop a kind of construction that will be suitable for the changed conditions of traffic. The table given above illustrates to what extent these policies have been carried out.

BITUMINOUS MACADAM ROADS.

ATLANTA, GA.—The work at Atlanta, Ga., consisted of grading and surfacing with bituminous macadam a section of the Peachtree road. Work was begun October 18, 1909, and completed June 25, 1910. Prior to October 18, 1909, the local authorities had partially graded 9,700 lineal feet of the road. This was completed and 6,144 cubic yards of earth were moved between stations 97+00 and 114+50 at a cost of $1,280.24; 11,529 cubic yards of stone were quarried at a cost of $4,863.85, or 42.2 cents per cubic yard, and crushed at a cost of $820.37, or 7.1 cents per cubic yard; 8,080 cubic yards of stone were hauled with hauling engines an average distance of 9,500 feet at a cost of $687.10, or 8.5 cents per cubic yard. The stone was spread in two courses: The first, 5.5 inches in depth, contained stones from 2 to 3.5 inches in size; and the second course, 5 inches in thickness, contained stones from 0.75 inch to 2 inches in size. After these two courses of stone had been thoroughly rolled, tar was applied at the rate of 2.55 gallons per square yard. The cost of applying 41,626 gallons was $718.48 and the cost of the tar was $2,081.30, or 5 cents per gallon. Three hundred and five cubic yards of chips and screenings were used. With labor at from 50 cents to $1.75 per day, convict labor at 50 cents per day, county teams at 75 cents per day, and fuel at from $1.80 to $3.50 per ton, the total cost of the work done was $19,336.58. No cost per square yard is available, as the work was begun before this Office had anything to do with this road and was continued after participation in the work by this Office had ceased.

EL PASO, TEX.—The work at El Paso, Tex., consisted of supervising the resurfacing of 23,470 square yards of old macadam road, and preparing plans and specifications for 11¼ miles of new construction, including a number of reinforced concrete bridges. The work of resurfacing was begun May 10, 1909, and entirely completed July 22, 1909. The dust was first swept off with wire brooms and the roadway spiked up with a road roller. The road was then shaped and given a crown of one-half inch to the foot, wet and rolled. A course of clean limestone, broken in sizes of from three-fourths of an inch to 1½ inches, was then spread upon the road to a depth of 3 inches, measured loose, and lightly rolled. Care was taken that the stone should remain free from dust and moisture. Asphalt, heated to about 300° F., was then evenly spread over the surface of the road, with flat nozzle sprinkling cans, at the rate of 15 pounds per square yard. Stone chips, one-half inch in size and free from dust, were then spread upon the road in sufficient quantity to fill the voids of the larger stone and were swept into place. The road was then thoroughly rolled and sufficient screenings were spread upon the road to take up any surplus asphalt. The cost of this work was as follows: Furnishing and rolling into place 2,525 cubic yards of stone, $4,923.98; furnishing 193.8 tons of asphalt, $3,882.22; cost of labor, $1,538; making a total cost of $10,344.20, which is at the rate of 44.08 cents per square yard.

PHOENIX, ARIZ.—An oil macadam road 3,250 feet in length and 16 feet wide was built at Phoenix, Ariz., between March 14, 1910, and May 7, 1910, during which twenty-four days were lost because of the failure of the contractor to deliver stone. The land over which the road was built is practically level and all earth was moved with a road grader. The local authorities furnished a 10-ton macadam road roller, two improved road oilers, two tank wagons, and a road grader. Fourteen hundred and thirty-six cubic yards of stone were delivered by contract on the road at a cost of $1.67 per cubic yard. The stone was spread in four courses. The first course, 5½ inches thick, was of stone between 1½ and 4 inches in size, with the voids filled with gravel. The second course, 2 inches thick, was of stone from three-fourths of an inch to

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1½ inches in size. The third course was of stone screenings three-fourths of an inch in size or smaller, and was applied in such amount as to fill the voids in the second course. The fourth course, of the same size stone as that of the third, was applied in such amount as was necessary to absorb what surplus oil remained on the surface. The oil was furnished in a tank car of 9,000 gallons capacity and was heated by steam coils to a temperature of 190° F. The road was given two applications of oil, the first at the rate of 1 gallon per square yard and the second at the rate of one-half gallon per square yard. The total cost of the road to the community was $3,875.05, which is at the rate of 67.06 cents per square yard, or $6,295.50 per mile. Labor was $2.25 per day, four-horse teams $6 to $6.50 per day, and six-horse teams $8.50 per day.

OIL-GRAVEL ROADS

SANTA MARIA, CAL.—The work at Santa Maria, Cal., consisted of surfacing with oiled gravel a section of the Geary road, 2,710 feet in length and 16 feet wide. The surface of the road was a sandy loam which had been oiled several times with crude oil, and was badly rutted and full of "chuck holes." The oiled surface was broken up by spiking with a roller, scarifying, and harrowing with a chisel-toothed harrow and a disk harrow. The road was then shaped with a road grader and 1,137 cubic yards of gravel were spread upon the road in two courses, 5½ and 3 inches in thickness. The average cost of the gravel was $1.683 per cubic yard, which included loading on flat cars, shipping a distance of 35 miles, hauling an average distance of 1 mile, spreading upon the road, rolling, and sprinkling.

The crude oil was applied at the rate of 1 gallon per square yard on the foundation course, 1 gallon per square yard on the second course, and one-fourth gallon per square yard on the surface. The oil was secured from the county sump. Waste oil from the oil fields floats on the surface of the small streams, which are diverted to the sump, and the only expense of the oil is that of collecting, heating, and pumping into tank wagons. With labor at $2 to $2.50 per day and teams at $4 per day, the total cost of the road to the community was $2,613.68, which is at the rate of 54.2 cents per square yard, or $5,087.57 per mile.

MACADAM ROADS.

CARLSBAD, N. MEX.—*La Huerta-Avalon road.*—The work of surfacing a road 1,600 feet in length at Carlsbad, N. Mex., was started on June 7, 1909, and the road was entirely completed July 2, 1910. The road was first thoroughly irrigated, after which the necessary excavation and shaping were done. Gypsum was then spread on the road in three courses to a width of 16 feet and to a total depth of 9 inches. Each course was rolled with a 4-ton horse roller. After the material had been spread, the road was flooded from an irrigation ditch for forty-eight hours. The road and shoulders were then reshaped with a road grader and rolled until a smooth, hard surface was obtained. The total cost of the work was $1,144.67. The cost of the several items of work was as follows: Foreman, $66; excavation and shaping, $53.50; stripping, quarrying, and loading 1,080 cubic yards of gypsum, $486.98; hauling 1 mile, $428.12; spreading, $79.97; irrigating, $7; rolling, $23.10.

Resurfacing section of La Huerta road.—A section of the La Huerta road, 900 feet in length, which was surfaced with gypsum several years ago, was resurfaced. All the loose material and detritus were removed from the surface by scraping and sweeping. Gypsum was then spread to a depth of 3 inches and all depressions were filled. An embankment 10 inches high was then built along each shoulder and the road was flooded from an irrigation ditch for thirty-six hours. The usual traffic was maintained on the road during the flooding. The water was then drained away and the roadway and shoulders were shaped with a road grader and rolled with a 4-ton horse roller. The new material was found to be firmly bonded to the old surface. The total cost of the work was $167, which is at the rate of $979.70 per mile.

Surfacing Green and Tax streets.—The work of surfacing Green and Tax streets was carried on in a manner similar to that of the La Huerta-Avalon road, except that the gypsum was put on 8 inches deep, and river sand 2 inches in thickness was spread and mixed with the top course of the gypsum. A section 1,415 feet long and 40 feet wide was surfaced at a cost of $704.43, which is at the rate of 28 cents per square yard. The cost of labor was $1.75 and of teams $3.75 per day of nine hours.

GREENVILLE, S. C.—The work at Greenville, S. C., consisted of grading, surfacing with water-bonded macadam a section of road 3,300 feet in length and 12 feet wide, and surfacing with bituminous macadam a section of road 500 feet in length and 12 feet wide. To secure proper grades and drainage, 3,201 cubic yards of earth were moved an average distance of 700 feet in slat-bottom farm wagons, at a cost of $412.75, or

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12.8 cents per cubic yard. Eleven hundred cubic yards of stone were shipped a distance of 20 miles and furnished f o. b. at Greenville at $1 per cubic yard. The stone was loaded with shovels into wagons at the car at a cost of 4 cents per cubic yard, hauled an average distance of 4,500 feet at a cost of 21 cents per cubic yard, and spread upon the road with shovels at a cost of 2 cents per cubic yard. The rolling was unsatfactorily done with a hauling engine having smooth-tired front and rear wheels at a cost of 2 cents per square yard. On account of frequent rains practically no sprinkling was done. The bituminous section was constructed by the penetration or grouting method. Fifteen hundred gallons of refined coal-gas tar were spread with hand-pouring pots at a cost of 2 cents per square yard. The tar cost 6 cents per gallon, and the total cost of the tar treatment was 17.5 cents per square yard. Two cross drains of concrete pipe, molded in place with concrete end walls, were constructed, one 24 inches in diameter and 40 feet long and one 36 inches in diameter and 45 feet long, at a total cost of $126. The total cost of the road to the community was $2,322, which is at the rate of $2,600 per mile for water-bonded macadam and $3,150 per mile for bituminous macadam. The work was begun on October 18, 1909, and was completed on January 1, 1910. The convict labor cost 50 cents per day and teams $2 per day.

WINCHESTER, TENN.—The work of improving the Winchester-Decherd road at Winchester, Tenn., was begun on June 11, 1909, and completed on December 13, 1909. The improvement consisted of opening 9,600 lineal feet of new road, grading it to the width of 28 feet from edge to edge of the shoulders, surfacing it 16 feet in width, and constructing cross drains of corrugated ingot iron as follows: One 28 feet long and 20 inches in diameter, one 38 feet long and 20 inches in diameter, one 38 feet long and 18 inches in diameter, three 26 feet long and 18 inches in diameter, and one 46 feet long and 12 inches in diameter. The grading required the moving of 9,749 cubic yards of earth, which was hauled an average distance of 891 feet in wheeled scrapers and slat-bottom farm wagons. The earth was loosened with picks and plows and the wagons loaded with shovels and drag scrapers. The total cost of excavation was $2,504.65, or 25.7 cents per cubic yard. Stone for the road was purchased for 85 cents per cubic yard. It was placed upon the road in three courses: The first course, 8 inches thick, measured loose, was of stone between 1½ and 3½ inches in size; the second course, 2 inches thick, measured loose, was from one-half inch to 1½ inches in size; and the third course, screenings smaller than one-half inch, was applied in sufficient quantity to bond the road, that is, to a depth of about 1 inch. Water for the roller and sprinkler was hauled a distance of 1 mile. The roller which was used was a 10-ton macadam roller and was hired for $7 per day, while the roller man was paid $3 per day. Five thousand one hundred and fifty-seven cubic yards of stone were hauled an average distance of 700 feet at a cost of 29.1 cents per cubic yard, spread upon the road with shovels and rock-rakes at a cost of 6.1 cents per cubic yard, and sprinkled and rolled at a cost of 6.1 cents per cubic yard. The total cost of the road to the community was $11,452.83, which is at the rate of 67.1 cents per square yard, or $6,299.06 per mile. The cost of labor was $1 per day, of teams $3 per day, and of coal $4 per ton.

MEXIA, TEX.—A macadam road was built at Mexia, Tex., 1,475 feet in length and 15 feet in width. Work was begun on July 13, 1909, and the road was completed on August 4, 1909. Six hundred and eight cubic yards of earth were moved with a road grader and with drag scrapers at a cost of $21.26. The stone used was a fossiliferous limestone picked up from the surface of adjoining fields and delivered to the crusher for 25 cents per cubic yard. Six hundred and thirteen cubic yards of stone were used, of which 329 were crushed at a cost of $106.78, and 284 cubic yards were purchased at 65 cents per cubic yard. The stone was hauled from the crusher to the road, an average distance of 13,000 feet, at a cost of $321.75, and spread with shovels and potato rakes for $41.63. Water was hauled 6,000 feet for sprinkling and for the roller. With coal at $5 per ton, the cost of rolling was $27.10. The total cost of the road to the community was $995.26, which is at the rate of $3,526.60 per mile. Labor cost $1.25 and teams $2.50 per day.

PROVO, UTAH.—A macadam road 2,850 feet in length and 15 feet in width was constructed at Provo, Utah, between October 25, 1909, and December 24, 1909. It was a part of a proposed improved road extending from the city of Provo to Provo Canyon, a distance of 6 miles. During this time eight and one-half days were lost on account of rain and snow. The immediate surrounding country is practically level. The soil over which the road was built is adobe, which, when wet, has very little ability to support a load. In winter the road was practically impassable. At the north end of the road it was necessary to make a hillside cut in a hill composed principally of rocks of quartzite varying in size from 2 to 12 inches in diameter, and on account of a large irrigation ditch running along the foot of the hill it was not practicable to push the

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material from the cut down the hillside. A plat was leveled off large enough to set up the crushing plant and the rocks were crushed and used as a foundation course 9 inches in thickness. This was covered 3 inches deep with limestone of excellent binding and fair wearing quality crushed until it was from three-fourths of an inch to 2 inches in size, and bonded in the usual way with limestone screenings. The rocks were loosened in the bank with a plow, hauled with tongue scrapers, and dumped through a "trap" into the crusher. The crushed material was elevated, passed through a revolving screen with three-fourths, 2, and 3 inch perforations, dropped into a bin of 25 cubic yards capacity, and loaded by gravity into slat-bottom farm wagons. It was necessary to break the large rocks with hammers, as the crusher opening was 9 by 18 inches. Power for the crusher was furnished by a 20-horsepower electric motor. The average power consumed was 15 horsepower, and this was had at a rate of $6.20 per horsepower month. The total cost of putting the crushed rocks into the bins was 42.9 cents per cubic yard. One thousand two hundred and thirty cubic yards of earth were excavated with a road grader at a cost of $96, or 7.8 cents per cubic yard. The average haul from the crusher to the road was 1,940 feet. The crushed material was spread on the road with shovels and rock-rakes and rolled with a 14-ton roller. With labor per day of eight hours at $2, teams at $4, and coal at $5.50 per ton, the total cost of the road to the community was $2,180.67, or 45.9 cents per square yard, which is at the rate of $4,039.62 per mile.

ROSSLYN, VA.—The work of building a macadam road at Rosslyn, Va., was begun on November 23, 1909, and completed on July 23, 1910. The road, 3,913 feet in length and 16 feet in width, was built through a hilly country over red clay soil. To secure proper grades and drainage 1,325 cubic yards of earth were moved with drag scrapers and in wagons an average distance of 500 feet. The macadam, laid in three courses, was 6½ inches in thickness when compacted. Two hundred and thirteen cubic yards of the first course, a local quartz stone of poor quality for road work, were quarried at a cost of 50 cents per cubic yard and crushed at a cost of 67 cents per cubic yard. For the remainder of the work 1,616 cubic yards of stone were purchased, shipped 38 miles by rail at a cost of $2,084.75, and hauled a distance of 4 miles to the road. Water for the roller and sprinkler was obtained from a tank by the roadside. The cost of sprinkling and rolling was 4.3 cents per square yard. Labor cost $1.50 per day, teams $4 per day, and coal $4.50 per ton. The actual cost of the road was $5,258.65. All labor and material was furnished by contract for $4,943.88, which is at the rate of $6,370 per mile, and which is the amount actually paid by the community.

GRAVEL ROADS.

KALAMAZOO, MICH.—*West street–Portage Center.*—The construction of the West street–Portage Center gravel road was begun on April 13, 1910, and on June 1, 1910, the work was completed. One thousand four hundred cubic yards of earth were excavated and hauled an average distance of 600 feet at a cost of $292.85, or 20.9 cents per cubic yard. It was loosened with plows and hauled in drag and wheeled scrapers. One thousand four hundred and forty-five cubic yards of gravel were placed upon the road at the following costs per cubic yard: Gravel in the pit, 10 cents; stripping the pit, 5 cents; loading at the pit, 4.6 cents; hauling an average distance of 3,500 feet, 32.4 cents; spreading on road, 1 cent; harrowing and rolling, 0.63 cent. The length of the surfaced road is 5,520 feet and the width 9 feet. The gravel was spread in two courses, the first course 7 inches thick and the second 4 inches. The maximum size of the gravel in the first course was 2½ inches in diameter and in the second course 1½ inches in diameter. The road was built with county convict labor, which was estimated at 40 cents per day, the cost of furnishing them food. The expense of guarding the convicts was $63.75. The total cost of the road to the community was $1,425.45, or 25.8 cents per square yard, which is at the rate of $1,365 per mile. This cost is based upon convict labor at 40 cents and teams at $4 per day.

Gull road, Kalamazoo Township.—The work of surfacing with gravel a section 3,200 feet in length of the Gull road, in Kalamazoo Township, for a width of 15 feet, was begun on June 1, 1910, and entirely completed on June 30, 1910. The plan of construction was similar to that of the Kalamazoo West Portage road. One thousand three hundred cubic yards of gravel were hauled an average distance of 1¼ miles at the following cost per cubic yard: Gravel in the pit, 10 cents; stripping the pit, 1.2 cents; loading in wagons, 5.3 cents; hauling to the road, 38.3 cents; spreading on the road, 0.6 cent; and harrowing and rolling, 0.5 cent. The gravel was spread to a depth of 11 inches at the center and 6 inches at the edges, measured loose. The total cost of the road to the community was $954.05, which is at the rate of 9 cents per square yard, or $1,574 per mile.

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BILLINGS, MONT.—The improvement at Billings, Mont., consisted in surfacing with gravel a section of the state road leading from Billings toward Laurel. A length of 3,960 feet was surfaced 14 feet wide. Two thousand five hundred feet of the road consists of alkaline gumbo and the remainder of "Billings clay." The surrounding country is quite level. A concrete culvert with an opening 2 feet high and 5 feet wide was built at a cost of $214.50, with cement costing $3.50 per barrel, sand and gravel $2 per cubic yard, steel 4½ cents per pound, and labor $3 per day of eight hours.

The gravel for the road was secured from a pit 2½ miles distant from the road. On account of the fact that the pit gravel contained about 20 per cent of rocks, 2½ to 6 inches in diameter, it was necessary to screen it. This was done and the screened gravel was loaded into wagons at a cost of 38.4 cents per cubic yard. The screening was done by building a high "trap" with a double driveway and placing a screen composed of bars of steel spaced 2½ inches apart at an angle of about 35° over one of the driveways, and dumping the gravel, hauled with drag scrapers, through the trap floor on the screen, so that the gravel less than 2½ inches in diameter fell into one wagon and that over that size fell into another. One thousand eight hundred and twenty-four cubic yards of gravel were placed on the road at a cost per cubic yard of 38.4 cents for screening and loading, 98.1 cents for hauling, and 2.5 cents for spreading. The total cost of the road to the community, with labor at $3 and teams at $6 per day of eight hours, was $3,557.32, or 57.7 cents per square yard, which is at the rate of $4,743.08 per mile. Work was begun on April 25, 1910, and the road was completed on June 18, 1910.

ARLINGTON, TEX.—On February 21, 1910, the work of building a gravel road 6,928 feet in length was begun at this point. The work was greatly delayed during the months of March, April, and May, on account of frequent rains, and was not completed during this fiscal year. A detailed statement of this work will be deferred until the next annual report.

SWEETWATER, TEX.—The work at Sweetwater, Tex., consisted of surfacing a section of road with a mixture of clay and gravel. The adjacent land is rolling and the soil a fine sandy loam. To secure proper cross section and drainage 394 cubic yards of earth were moved with drag scrapers and slat-bottom wagons an average distance of 200 feet at a cost of $81.95, or 21 cents per cubic yard. Six hundred and eight cubic yards of clay were loaded at a cost of $102.35, hauled a distance of 1½ miles at a cost of $300.85, and spread upon the road to a depth of 5 inches, with a road grader, at a cost of $19.40. Three hundred and seventy-one cubic yards of gravel were loaded at a cost of $63.45, hauled 1½ miles at a cost of $197.25, and spread upon the road with a road grader to a depth of 4 inches at a cost of $11.25. The clay and gravel were mixed at a cost of $17.60, and sprinkled and rolled at a cost of $17.50. With labor at $1.80 per day and teams at $3.50 per day the cost of the road to the community was $989.05, which is at the rate of 27 cents per square yard. The work was begun on March 31, 1910, and the road was entirely completed on April 27, 1910.

SAND-CLAY ROADS.

DOTHAN, ALA.—The work at Dothan, Ala., consisted of grading a section 4,000 feet in length of the Columbia road and surfacing with a sand-clay mixture a section of the graded road 1,600 feet in length and 14 feet wide. The work was begun on May 4, 1910, and completed on May 26, 1910. The adjacent country is hilly and the soil sandy. To secure proper grades and drainage 2,000 cubic yards of earth were moved an average distance of 100 feet with a road grader and wheeled scrapers at a cost of $120.85. Eight hundred and twenty-nine yards of surfacing material were hauled an average distance of 300 feet, spread upon the road, and mixed at a cost of $99.77. One cross drain of corrugated iron, 24 inches in diameter and 24 feet long, was constructed at a cost of $24. Two wooden culverts were built, one 4 feet high, 10 feet wide, and 20 feet long, at a cost of $38.70, and one 9 feet high, 16 feet wide, and 20 feet long at a cost of $65.47. Part of the road was relocated, and grubbing was done that cost $60.78. With labor at $1 per day and teams at the cost of subsistence—that is, 70 cents per day—the total cost of the road to the community was $479.02, which is at the rate of $632.30 per mile.

TYLER, ALA.—Work on the construction of a sand-clay road at Tyler, Ala., through a level country over deep sand was begun on May 3, 1909, and completed on July 29, 1909. The work consisted of surfacing, with a sand-clay mixture, a road 4,300 feet in length and 20 feet wide. Clay to the amount of 2,785 cubic yards was hauled a distance of 1½ miles, spread upon the road about 12 inches thick and mixed with sand by means of plows, harrows, and a road grader. A vitrified clay tile cross drain 12 inches in diameter and 30 feet in length was put in. The work was done with the county convict road force. The cost of labor was based upon the cost of feeding and guarding the convicts,

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which was 75 cents per day, and the cost of feeding the teams, which was $1 per day. The total cost of the road to the community was $1,628.40, which is at the rate of 17 cents per square yard, or $1,969.32 per mile.

PALATKA, FLA.—The work at Palatka, Fla., consisted of grading and surfacing a section, 5,000 feet in length, of the Bostwick road. The adjacent country is low and level and the soil sandy. Since the road was a new one which had been laid out through a forest, it was necessary to grub more than 400 trees and stumps, and this was done at a cost of $239.11. To secure proper drainage, 580 cubic yards of earth were moved at a cost of $116.75, or 20.1 cents per cubic yard. Fifteen hundred cubic yards of clay were hauled an average distance of 1 mile, and for a width of 14 feet were spread upon the road to a depth of 8 inches at the center and 6 inches at the sides, at a cost of $1,167.48. With labor at $1.25 per day and teams at $4 per day the total cost of the road to the community was $1,646.35, which is at the rate of $1,738.53 per mile.

ALBANY, GA.—The work at Albany, Ga., consisted of surfacing a road 5,775 feet in length with a natural sand-clay mixture for a width of 20 feet. The surrounding country is level and the soil in the road is quite sandy. Earth to the amount of 3,722 cubic yards was excavated at a cost of $345.20, or 9.27 cents per cubic yard. The natural sand-clay mixture was hauled an average distance of 1,200 feet and spread 8 inches thick. The cost of loading was 6.5 cents, of hauling 7.3 cents, and of spreading 1.4 cents per cubic yard. The labor used was convict, which is estimated at 50 cents per day, with county teams at $1 per day. The total cost of the road to the community was $838.30, which is at the rate of $766.45 per mile. Work was begun on March 26, 1910, and the road was entirely completed on May 3, 1910.

AMERICUS, GA.—The work at Americus, Ga., consisted in demonstrating the proper method of building a sand-clay road. A section of clay road 528 feet in length was graded ready for the demonstration. One hundred and ninety-five cubic yards of sand were hauled a distance of 3 miles and spread upon the road with shovels. The sand and clay were mixed with plows and harrows, and the road was shaped with a road drag. The work was done by the county convict road gang. With labor at 60 cents and teams at the cost of subsistence, that is, $1 per day, the total cost of the improvement was $92, which is at the rate of $920 per mile. Work was begun on August 26, 1909, and completed on September 1, 1909.

BLAKELY, GA.—The construction of a sand-clay road at Blakely, Ga., was begun on January 25, 1910, and completed on March 5, 1910. A section of the Gordon road, 5,300 feet in length, was graded for a width of 30 feet. The surface of the old road was gray sand underlaid, at a depth of a foot or two, with clay, and, in grading the road, about half of the material excavated was used for surfacing. Seventeen hundred and thirty-two cubic yards of earth were excavated at a cost of $145.11, and 1,005 cubic yards of clay were loaded and hauled in wagons an average distance of one-half mile at a cost of $162.35. Cross drains, 20 feet in length, with concrete end walls, were constructed, at a cost of $120.37, as follows: One 12-inch and one 15-inch vitrified clay tile and two concrete boxes with waterways 1 by 2 feet. The total cost of the road to the community was $731.77, or $611 not including the cost of the culverts. The work was done by the county convict road gang, and the cost of labor and teams was the cost of guarding and feeding the convicts, and feeding the teams, which was 45 cents per day for labor and $1.60 per day for teams.

BRUNSWICK, GA.—A very sandy road, 1,200 feet in length, at Brunswick, Ga., was surfaced, for a width of 12 feet, with a sand-clay mixture. Work was begun on April 7, 1910, and completed on April 26, 1910. The grade and shape of the road were satisfactory and the work consisted only of surfacing. Clay could be secured only from a marsh, which was covered with water at high tide. It was wheeled out of the pit in wheelbarrows and dumped on a platform, from which it was loaded into one-horse carts of about one-third cubic yard capacity, hauled an average distance of one-half mile, spread upon the road to a depth of 10 inches, and mixed with the sand with a plow and disk harrow. Labor cost 85 cents per day and one-horse carts $3 per day. The cost of the road to the community was $470.14, which is at the rate of $2,068.62 per mile.

COLQUITT, GA.—The work at Colquitt, Ga., consisted of grading one-half mile of earth road and surfacing with a sand-clay mixture a section of very sandy road, 800 feet in length. The clay, of which 110 cubic yards were needed for the sand-clay mixture, was obtained by trenching along the roadside and was mixed with the sand with a plow and road grader. The cost of moving 800 cubic yards of earth with a road grader was $24.45, or 3 cents per cubic yard. All work was done by the county convict road gang, at a cost of 50 cents per day for labor and $1.20 per day for teams. The total cost of the road to the community was $66.73, which is at the rate of $133.46 per mile. Work was begun on March 10, 1910, and entirely completed on March 16, 1910.

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STUMP NECK, MD.—The work at Stump Neck, Md., begun on June 15, 1910, and completed on June 25, 1910, consisted of grading and surfacing with a sand-clay mixture a section of road 580 feet long and 14 feet wide, and a section 400 feet long and 8 feet wide. The cost of grading was $40.80. Two hundred and ten cubic yards of surfacing material were loaded, hauled an average distance of 1,500 feet, and spread upon the road at a cost of $77.65. The total cost of the road to the community was $150, which is at the rate of $985.60 per mile for a 14-foot roadway.

BRANDON, MISS.—Work at Brandon, Miss., was begun on September 6, 1909, and was completed on November 11, 1909. It consisted of grading and surfacing, with a sand-clay mixture, a section of road 5,344 feet in length and 18 feet wide, and constructing a number of cross drains. The adjacent country is hilly and the soil, which is quite variable, has the following nature along the road: Station 0 to station 10, stiff clay; station 10 to station 13+50, sand-clay mixture; station 13+50 to station 17, deep sand with a clay subsoil; station 17 to station 24, sand and clay with sand predominant; station 24 to station 28, deep sand; station 28 to station 31, sand-clay mixture; station 31 to station 35+50, sandy clay; station 35+50 to station 40, clay; station 40 to station 46, sand and clay; station 46 to station 50, sandy soil; station 50 to station 53+44, clay. To secure proper grades and drainage, 6,097.4 cubic yards of earth were moved an average distance of 350 feet at a cost of $1,743.85, or 28.6 cents per cubic yard. A long drought had caused some portions of the road to become so hard that they could not be plowed and it was necessary to loosen the earth by blasting and with picks, which increased the cost of excavation quite materially. By properly distributing the earth that was excavated a great portion of the road was practically surfaced with a sand-clay mixture when the excavation was completed. Nine hundred cubic yards of surfacing material were hauled an average distance of 3,300 feet at a cost of $211.80. Cross drains with concrete end walls were constructed as follows: One concrete box culvert, 27 feet long, with a waterway 24 inches by 21 inches; one concrete box culvert, 27 feet long, with a waterway 24 inches by 15 inches; one vitrified clay tile drain, 25 feet long, 15 inches in diameter; two vitrified clay tile drains, 27.5 feet long, 18 inches in diameter; one vitrified clay tile drain, 27.5 feet long, 15 inches in diameter; one vitrified clay tile drain, 27.5 feet long, 12 inches in diameter; one vitrified clay tile drain, 57½ feet long, 18 inches in diameter. With labor at from $1 to $1.25 per day and teams at $3 per day, the total cost of the road to the community was $2,980.40, which is at the rate of $2,815.54 per mile.

CHARLESTON, MO.—Funds for the improvement of a very sandy road leading north from Charleston, Mo., were raised by subscription by the business men of Charleston, excepting $250, which was paid from the county funds. Work was begun on August 6, 1909, and this road was entirely completed on August 26, 1909. The road was graded 30 feet in width between ditches for a length of 5,050 feet, and a strip 15 feet in width in the center was surfaced with a sand-clay mixture. For the surfacing, 1,300 cubic yards of clay were hauled an average distance of 5,000 feet in slat-bottom farm wagons of 1 cubic yard capacity, at a cost of $569.10. The cost of loading the clay was 23.8 cents and of spreading upon the road 4.25 cents per cubic yard. Nine hundred and thirty-one cubic yards of earth were excavated and hauled an average distance of 400 feet at a cost of 19.4 cents per cubic yard. The total cost of the road to the community was $1,302.77, which is at the rate of $1,360.48 per mile. Labor cost $1.50 and teams $3 per day.

MAGNOLIA, MISS.—Work was begun at Magnolia, Miss., on May 18, 1910, and was completed on June 10, 1910. It consisted of building a sand-clay road 1,200 feet in length and 15 feet in width, putting in an 18-inch vitrified tile drain 30 feet in length and building a wooden culvert 23 feet in length with an opening of 3 by 5 feet. The road was built through a rolling country on a heavy clay soil. Four hundred and seventy-four cubic yards of earth were moved an average distance of 200 feet at a cost of 25.4 cents per cubic yard. Sand to the amount of 222.2 cubic yards was loaded in wagons with shovels at a cost of 17.9 cents, hauled an average distance of 1 mile at a cost of 20.7 cents per cubic yard, and spread upon the road with shovels at a cost of 14.07 cents per cubic yard. This work was done with convict labor, and the total cost to the community, with guards at $1, convicts at 80 cents, mules at 50 cents, and hired teams at $4 per day was $338.40, which is at the rate of $1,488.96 per mile, or 10.1 cents per square yard.

BENTON, MO.—Two sand-clay roads were constructed at Benton, Mo., one on a sandy soil and the other on a gumbo soil, to illustrate the methods of construction on a sand base and on a clay base. Work was begun on September 13, 1909, and completed on October 6, 1909. The first road, 850 feet in length, was constructed on a sandy soil. To secure proper grades and drainage, 250 cubic yards of earth were moved with drag

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scrapers and a road grader at a cost of $15. Gumbo was hauled an average distance of 6,000 feet and spread 15 feet in width and 10 inches deep, and mixed with the sand with plows and a road grader. The total cost of the road was $184.01, which is at the rate of $1,143 per mile.

The second road, 1,125 feet in length, was built on a gumbo soil. To secure proper drainage 855 cubic yards of earth were moved with drag scrapers and a road machine at a cost of $53.38. Sand was hauled an average distance of 600 feet and spread over the road for a width of 15 feet and a depth of 11 inches. The sand and clay were mixed with plows and a road grader. The cost of this section was $127.70, which is at the rate of $599.30 per mile.

FREMONT, NEBR.—The work at Fremont, Nebr., consisted of building a sand-clay road 5,221 feet in length and 16 feet wide through a level country on gumbo soil. The road was satisfactorily graded and the work consisted in surfacing it. Sand shipped 4½ miles by rail and hauled three-fourths of a mile in wagons was spread from 5 to 6 inches deep and 16 feet wide over the gumbo, which had previously been plowed and pulverized for a depth of from 4 to 5 inches. Considerable difficulty was experienced in getting the sand and gumbo thoroughly mixed, but by wetting the road quite thoroughly fair results were obtained. Water was obtained by pumping with a gasoline engine, from driven wells along the roadside. The sand was delivered at the railroad siding for 42.5 cents per cubic yard. With labor at $2.25 per day and teams at $4 per day, the cost of the road to the community was $2,064.24, which is at the rate of 22.24 cents per square yard or $2,087.59 per mile.

RAVENNA, NEBR.—At Ravenna, Nebr., the work consisted of building a sand-clay road 4,935 feet in length and 12 feet in width over a sandy soil. At a cost of 6.2 cents per cubic yard, clay to the amount of 2,120 cubic yards was loaded into wagons with an elevating grader, hauled an average distance of 1,525 feet at a cost of 12.2 cents per cubic yard, and spread with a road grader at a cost of 3.1 cents per cubic yard. The total cost of the road to the community was $628.88, which is at the rate of 4.4 cents per square yard or $672.84 per mile. The cost of labor was $2.25 and teams $4 per day. The work was begun on October 4, 1909, and completed on October 20, 1909.

STUART, NEBR.—The work at Stuart, Nebr., consisted in surfacing with sand-clay 4,520 feet of road 18 feet wide over gumbo and black prairie soil. Work was begun on June 29, 1909, and completed on July 27, 1909. Eighteen hundred and and sixty-eight cubic yards of earth, removed from a cut, were found suitable for surfacing and were hauled an average distance of 1,700 feet in wheeled scrapers and wagons, and spread upon the road with shovels and a road grader, at a cost of $781.66. The wagons were loaded with an elevating grader drawn by a traction engine. One hundred and thirty cubic yards of sand were required and were hauled an average distance of 600 feet. The total cost of the road to the community was $875.32, which is at the rate of $1,022.47 per mile.

EDENTON, N. C.—Two roads were built at Edenton, N. C., between May 26 and June 27, 1910. The first, 500 feet in length, was built as an experiment to determine the value of a clay which consisted of a fine slate-colored silt. A very sandy road was surfaced with this clay 16 feet wide and 9 inches deep. The sand and clay were mixed with plows, harrows, and a road grader. The indications were that the material would make a fairly satisfactory road. The total cost of this experimental road was $137.05, which is at the rate of $1,440 per mile.

The second road, 1,600 feet in length, over very sandy soil, was surfaced with a sand-clay mixture for a width of 12 feet. To secure proper grades and drainage 500 cubic yards of earth were moved an average distance of 200 feet, at a cost of $79.65. Five hundred and seventy cubic yards of surfacing material were used, and provided a wearing surface about 8 inches in thickness. The total cost of this road to the community was $206.20, which is at the rate of $680 per mile. The cost of labor was $1 and of teams from $2.50 to $5 per day.

LAURINBURG, N. C.—On August 30, 1909, the work of grading and surfacing with a sand-clay mixture 5,200 feet of the Maxton road at Laurinburg, N. C., was begun and on September 25, 1909, it was entirely completed. Fourteen hundred and ninety-eight cubic yards of earth were excavated and hauled with wheeled scrapers and wagons an average distance of 250 feet, at a cost of $269.50. Thirty feet of 16-inch, 96 feet of 18-inch, and 48 feet of 24-inch vitrified pipe were furnished, at a cost of $85.80, and laid for cross drains. The first 4,000 feet of the road were sand and the remainder, 1,200 feet, was clay. Clay was hauled from the clay section to the sand section, and sand from the sand section to the clay section in such quantities as to

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give a compacted wearing surface of a sand-clay mixture 12 feet wide and 4 inches thick. The total cost of the road to the community was $705.62, which is at the rate of $718 per mile. Labor cost $1 and teams $3 per day.

NASHVILLE, N. C.—The work of building a sand-clay road at Nashville, N. C., 2,300 feet long and 12 feet wide, was begun on August 9, 1909, and completed on August 17, 1909. The adjacent land is rolling and the soil sandy. To secure proper drainage 495 cubic yards of earth were moved with drag scrapers and a road grader an average distance of 75 feet, at a cost of $59.40, or 12 cents per cubic yard. Six hundred and eighty-two cubic yards of surfacing material were hauled in one-horse carts an average distance of 800 feet and spread upon the road to a depth of 10 inches in the center and 6 inches at the sides, at a cost of $81.70. The total cost of the road to the community was $180.94, which is at the rate of $341.19 per mile. Labor cost $1 per day, one-horse carts $1.50 per day, and teams $3 per day.

SALISBURY, N. C.—The local authorities at Salisbury, N. C., had graded 1 mile of clay road for a width of 25 feet between shoulders and had covered a strip 10 feet in width with sand about 6 inches deep. The work therefore consisted in mixing the sand and clay and adding additional sand where needed. Two hundred and seventy-eight cubic yards of sand were hauled three-fourths of a mile and spread upon the road at a cost of $157.30. The sand and clay were then mixed with plows and harrows at a cost of $9.60. The work was done by the county convict road gang. With labor at 40 cents and teams at the cost of subsistence—that is, 80 cents per day—the total cost of the work was $198.75. Work was begun on September 21, 1909, and completed on September 27, 1909.

DARLINGTON, S. C.—The work of constructing a sand-clay road at Darlington, S. C., was begun on June 27, 1910. The proposed road will be 3,780 feet in length and surfaced with a sand-clay mixture 20 feet in width. Since the work was not completed in this fiscal year, a detailed statement of it will be deferred until the next annual report.

FLORENCE, S. C.—The work at Florence, S. C., consisted of improving a section of the Dargan road, 1,000 feet in length, with gravel and a sand-clay mixture. One hundred and seventy feet were surfaced with gravel which had been shipped in by rail previous to the arrival of the representative from this office. The remainder of the section, 830 feet, was surfaced with a sand-clay mixture. The clay and sand which were used were obtained practically from the roadside, at a cost of about one-fifth that of the gravel. Fifty-eight cubic yards of gravel were purchased at 83 cents per cubic yard, hauled a distance of 1 mile, and spread upon the road at a total cost of $85.90. The cost of the sand-clay section was $77.90. The work was done by the county convict road gang and labor was estimated at 40 cents per day, horse and cart at $2 per day, and teams at $3 per day.

HARTSVILLE, S. C.—A sand-clay road, 5,280 feet in length, was built at Hartsville, S. C., through a practically level country on a sandy soil. Under the sandy soil, which was about 1 foot in thickness, was found a good quality of clay. A wide trench was dug along both sides of the road, the sandy soil was thrown to the outside of the road, and the clay, sufficient for a 10-inch sand-clay surface, was dragged to the middle of the road. The sand and clay were then spread and mixed with a road grader. All surplus sand was drifted back into the trench. Cross drains of vitrified pipe were constructed as follows: Two 24-inch, 50 feet long; one 30-inch, 40 feet long; one 15-inch, 24 feet long; and one 12-inch, 24 feet long. All labor was performed by jail convicts, which cost the county for feeding and guarding 50 cents per day for each man. The total cost of the road to the community was $338, including the cross drains, and $134.75 exclusive of the cross drains. Teams were furnished by the county, and as a rule driven by the convicts, and were considered as costing the county $1.50 per day. Work was begun on June 2, 1910, and the road was completed on June 21, 1910.

MARION, S. C.—The work at Marion, S. C., consisted of grading to a width of 30 to 40 feet 4,750 lineal feet of road and surfacing it for a width of 16 feet with a sand-clay mixture. The country adjacent to the road was level and the soil quite sandy. Work was begun on May 31, 1910, and completed on July 21, 1910. In grading the road, 1,456 cubic yards of earth were loosened with plows and picks, and hauled in wagons and wheelbarrows an average distance of 500 feet at a cost of 23.5 cents per cubic yard. One thousand and fifty-five cubic yards of clay were used on the road for the sand-clay mixture, of which 656 cubic yards were hauled an average distance of 1,500 feet, while the remainder, 399 cubic yards, was obtained from trenches dug

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along the roadside. The work was done by the county convict road gang, and the cost of labor was the cost of feeding and guarding the convicts, which was 35 cents per day. Teams were owned and furnished by the county, and the cost of team labor was estimated at the cost of subsistence, which was $1 per day. The total cost of the road to the community was $609.06, which is at the rate of 3 cents per square yard, or $677.02 per mile.

NEWBERRY, S. C.—Work was begun at Newberry, S. C., on the construction of 5,360 feet of sand-clay road, on May 26, 1909, and the road was completed on July 15, 1909. Since the natural grades were satisfactory, no grading was required. The clay was secured from the bottom of the side ditches, loosened with picks, and thrown on the road with shovels. The roadway was 20 feet wide between the ditches and was covered with clay to a depth of 8 inches at the center, gradually diminishing in thickness to nothing at the edges. Sand was hauled an average distance of 2,000 feet and spread 6 inches deep at the center, gradually diminishing to nothing at the edges. The sand and clay were mixed with plows, harrows, and a road grader. Three cross drains of vitrified clay tile were constructed, together with one of corrugated iron 18 inches in diameter and 20 feet long with rubble masonry head walls. The work was done with the county convicts and teams. Labor was estimated at 30 cents per day and teams at $1.30 per day, which is the cost of feeding. The cost of guarding the convicts with guards at $1 per day was $48. The total cost of the road to the community was $515.49, which is at the rate of 4.33 cents per square yard, or $508.04 per mile.

WINNSBORO, S. C.—The work at Winnsboro, S. C., consisted of grading a section of the Rockton road 1,700 feet in length and 40 feet in width, except a section 400 feet in length, which was graded to a width of 20 feet, and surfacing a section 600 feet in length with a sand-clay mixture. The country is quite hilly and the soil a red clay. To secure proper grades and cross section, it was necessary to excavate 1,658 cubic yards of earth, which was done with picks and shovels. This earth was then hauled in slat-bottom wagons an average distance of 400 feet, at a cost of $163.10. Two hundred and sixty-six cubic yards of sand were hauled, spread upon the road 8 inches deep, and mixed with the clay by means of plows and harrows. To protect the abutment of a bridge in the line of the work 33 cubic yards of riprap were placed about it at a cost of $7.20. The work was done by the county convict road gang. With labor at 30 cents per day and teams at $1.50 per day, the cost of the improvement was $203, which is at the rate of $807.73 for the completed road. Work was begun on August 2, 1909, and completed on August 14, 1909.

PARIS, TEX.—Work was begun at Paris, Tex., on August 9, 1909, and the road was entirely completed on August 27, 1909. Two days' time were lost in waiting for a concrete culvert, which had been constructed in the line of work, to harden sufficiently to remove the forms. The road, 5,280 feet in length, was graded to a finished width of from 32 to 35 feet, including the entire width of the shoulders. Twenty-six hundred cubic yards of earth were loosened by plows, and moved an average distance of 150 feet with drag and wheeled scrapers, at a cost of 11 cents per cubic yard. The adjacent land is rolling and at station 2+85 and station 43+87 concrete culverts, with spans of 10 feet, were constructed at a cost of $323.09. Clay was hauled an average distance of 600 feet with wheeled scrapers and spread over the road for a width of 20 feet, and a thickness of 7 inches in the center and 4 inches at the edges. Sand was spread over the clay from the sides of the road with a road grader, and the sand and clay were mixed with plows and harrows. The road was then completed by rolling with a 10-ton steam roller. The total cost of the road to the community, exclusive of bridges, was $900, with labor at $1.50 and teams at $3 per day of ten hours.

EARTH ROADS.

AMERICUS, GA.—The work of grading 1 mile of road at Americus, Ga., was begun on August 25, 1909, and completed on September 18, 1909. The road was graded to a width of 30 feet, including the entire width of the shoulders, and, to secure proper grades, 6,400 cubic yards of earth and 100 cubic yards of stone were moved with wheeled scrapers and in wagons for an average distance of 600 feet at a cost of $621.80. A cross drain was constructed of corrugated iron, 12 inches in diameter and 34 feet long, at a cost of $35. The work was done by the county convict road gang, and the cost of labor and teams was the cost of subsistence, which for labor was 60 cents and for teams $1 per day. The total cost of the road was $656.80.

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DE SOTO PARISH, LA.—The work in De Soto Parish, La., consisted of clearing the right of way and grading the Main Street road at Mansfield a distance of 2 miles, the Battlefield road at Mansfield a distance of 1¼ miles, and the Mansfield-Shreveport road a distance of 17 miles. The Main Street road at Mansfield was graded to a width of 24 feet from shoulder to shoulder. The natural soil is a mixture of sand and clay and no surfacing was done. Twenty-two hundred cubic yards of earth were moved. The Battlefield road for a distance of 1¼ miles from the city limits of Mansfield was improved in the same manner as the Main Street road. The Mansfield-Shreveport road was improved by clearing the right of way of trees, stumps, and brush, grading, surfacing certain sections with a sand-clay mixture, and constructing a number of cross drains. One carload of various sizes of corrugated ingot iron was used, costing $1,530.88. Three hundred and sixty lineal feet of oak timber bridging and one concrete box culvert were constructed. The total cost of the above work was $16,206, which is at the rate of $781 per mile. The work was done by the state convict road gang, and the cost of labor was the cost of guarding and feeding the convicts, which was 24 cents per day. The teams were owned and furnished by the State, and their cost was the cost of their maintenance, which was 50 cents per day per mule. Work was begun on June 16, 1909, and was completed on August 1, 1910.

OUACHITA PARISH, LA.—The work in Ouachita Parish, La., consisted of improving 14¾ miles of the Claiborne road leading from West Monroe to Calhoun, and 2½ miles on the Arkansas road from West Monroe, or a total of 17¼ miles, of which 13 miles are earth and 4¼ miles are gravel. Equipment, furnished by the State at a cost of $12,854.69, consisted of a 25-horsepower traction engine, a steam road roller, 2 heavy road graders, 6 cages or cars for housing the convicts, tents, harness, etc. The gravel was spread for an average width of 15 feet, with a depth of 8 inches at the center and 6 inches at the sides. The total cost of the gravel road was $10,002.73, and of the earth road $12,016.29. The work was done by the state convict road gang. Work was begun on July 10, 1909, and completed on August 1, 1910.

EAST BATON ROUGE PARISH, LA.—The work in East Baton Rouge Parish, La., consisted of clearing, grading, and draining 7.6 miles of the Claygut road and 1.7 miles of the Loop road, and surfacing with gravel 12,083 square yards on North boulevard in the city of Baton Rouge. The work was done by the state convict road gang and was begun on October 11, 1909, and completed on August 1, 1910. The cost of the work done upon the Claygut road was $4,882.82, which includes $1,770.67, the cost of the materials for cross drains. The cost of the work done upon the Loop road was $1,494.63, of which $149.46 was for materials for cross drains. The cost of graveling the North boulevard road was $6,043.94, which is at the rate of 50.2 cents per square yard. Gravel was delivered f. o. b. cars at Baton Rouge at $1.37 per cubic yard.

LAWTON, OKLA.—The work at Lawton, Okla., consisted of grading an earth road 5,206 feet in length for a width of 30 feet and building a culvert 20 feet wide with a clear span of 16 feet. Work was begun on July 20, 1909, and entirely completed on September 1, 1909, with a loss of seven and one-half days on account of the very hot weather. Fifty-eight hundred and forty cubic yards of earth were loosened with plows and moved in drag scrapers an average distance of 200 feet at a cost of $846.40. The culvert consisted of concrete abutments, wood stringers, and floor. With cement at $2 per barrel, lumber at $26 per 1,000 feet, board measure, labor at $1.60, and teams at $3.20 per day of eight hours, the total cost of the improvement to the community was $1,110.85, which is at the rate of $1,126.60 per mile.

PROVO, UTAH.—An earth road 8,850 feet in length and 23 feet in width from shoulder to shoulder was constructed at Provo, Utah, between August 24, 1909, and November 30, 1909. This road is a part of a road which it was proposed to improve from the city of Provo to Olmstead, a distance of 6 miles. The surrounding country is rolling and mountainous. Thirty-one hundred feet of the road were built through and along hills composed of gravel and rocks, and the remainder, 5,750 feet, was built over practically level adobe land. Eighty-five hundred and sixty cubic yards of earth were moved for an average distance of 1,160 feet. About 4,000 cubic yards were hauled in wagons and the remainder was moved with a road grader, tongue scrapers, and wheeled scrapers. All the materials were loosened with plows, and the wagons were loaded with tongue scrapers dumping through a "trap." The material in the rock banks was quite difficult to loosen and haul in the scrapers on account of the large rocks, many of which were 12 inches or more in diameter. In some places the old road was so narrow that two vehicles could not pass each other; these passages were widened to 23 feet. With labor at $2 and teams at $4 per day of eight hours, the total cost of the road to the community was $3,157.75, which is at the rate of $1,947.77 per mile.

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EXPERIMENTAL WORK AT YOUNGSTOWN, OHIO.[a]

The work at Youngstown, Ohio, consisted of surfacing with blast-furnace slag a section of road, 2,754 feet in length, just outside of the city limits on Belle Vista avenue. The slag was taken from a bank that had aged about two years and where the material came from six furnaces of the same type. A steam shovel was used to load the slag into gondola cars and these cars were drawn to a gravity screen, where the slag was dumped into a chute and passed over the screen to separate it into proper sizes. At first a 3½-inch screen was used. The finer screenings fell into one car and the coarser into another. The latter material, as a rule, was soft and crumbly, and was discarded. The screened slag was quite uniform in character and, after being properly sized, was taken by rail to a siding 1½ miles from the road upon which it was to be used. The grading of the entire road was done by contract at 22 cents per cubic yard and the total cost, including the cost of some retaining walls, was over $2,000. Seven different experiments were carried out as follows:

Experiments Nos. 1, 2, and 3 were practically regular macadam work. Experiment No. 4 was regular macadam work, except that open-hearth slag screenings, ranging in size from one-fourth inch to dust, were used in place of blast-furnace slag screenings. Experiment No. 5 was regular macadam work, except that 5 per cent of powdered quicklime was mixed with the blast-furnace slag screenings, varying in size from ¾ inch to dust. In mixing the two the screenings were measured out on a mixing board and the 5 per cent of lime was spread on the top. This was turned twice, and then spread upon the road, sprinkled, and rolled. Experiment No. 6 was constructed of blast-furnace slag just as ordinary macadam, except that a concentrated waste sulphite liquor preparation of 1.273 specific gravity was mixed with water and used to puddle the surface. In experiment No. 7 the first course of slag, varying in size from 1½ inches to 3½ inches, was laid loose to a depth of 9 inches and rolled until firm. The second course, 4 inches in depth when loose, consisted of 3 parts of slag, varying in size from three-fourths inch to 1½ inches, 1 part of slag screenings varying in size from three-eighths inch to dust, and 6 per cent of refined coke-oven tar. After this course was spread and rolled, a flush coat of tar was applied at the rate of one-fourth gallon per square yard. A thin coat of slag screenings was then spread over the road to take up any surplus tar. The cost per square yard of the various experiments was, for No. 1, 46.52 cents; No. 2, 43.34 cents; No. 3, 51.96 cents; No. 4, 50.21 cents; No. 5, 48.18 cents; No. 6, 61.31 cents; and No. 7, 68.45 cents.

EXPERIMENTAL WORK AT ITHACA, N. Y.

The experiments at Ithaca, N. Y., were conducted by the Office of Public Roads in cooperation with Cornell University for the purpose of ascertaining the relative value of different road binders applied in a number of ways under given conditions. In the experiments where bitumens were employed as binders, an attempt was made to try out all materials according to two methods of construction—the penetration method and the mixing method. The roads selected for these experiments are known as the Forest Home drive, which, starting at Central avenue just west of Sibley College, runs east to the city limits, 3,000 feet, and state road No. 681, which runs from Ithaca to Dryden and is a continuation of the Forest Home drive road. The stone used was a hard blue limestone costing $1.10 per ton f. o. b. cars at Ithaca.

Fifteen experiments were made, as follows: Ten with bituminous binders, of which 6 were by the penetration method, 3 by the mixing method, and one with Kentucky rock asphalt; 1 with slag macadam; 3 of concrete; and 1 of brick. The cost of constructing the various sections was excessive, owing to the shortness of the sections, which was only about 300 feet, and the constant rearrangement of labor and machinery which was made necessary by the variety of the work. The average cost per square yard of the bituminous sections constructed by the penetration method was 50.11 cents, of those constructed by the mixing methods 58.51 cents, and of the Kentucky rock asphalt section 83.04 cents. The cost per square yard of the slag section was 49.56 cents, of the concrete sections 69.63 cents, and of the brick section 254.96 cents.

INSPECTION OF OBJECT-LESSON ROADS.

During the last fiscal year inspections were made of twenty-eight object-lesson roads at the following places: Eufala, Ala.; Opelika, Ala.; Seale, Ala.; Union Springs, Ala.; Montague, Cal.; Fernandina,

[a] Circular 92 of this Office contains a complete description of these experimental roads.

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Fla.; Gainesville, Fla.; Jacksonville, Fla.; Americus, Ga.; Athens, Ga.; Hinesville, Ga.; Statesboro, Ga.; Waycross, Ga.; Pendleton, Oreg.; Salem, Oreg.; Southport, N. C.; Abbeville, S. C.; Newberry, S. C.; Sumter, S. C.; Cumberland Gap, Tenn.; Beaver Dam, Va.; Emporia, Va.; Norfolk, Va.; and Williamsburg, Va. Some were found in excellent, some in fair, and some in very poor condition. Very few had received systematic maintenance and many had received none at all. In some instances the nature and the amount of traffic have changed very greatly since the road was built. The road, which may have been suitable for the conditions and traffic at the time of its construction, may not be suitable for the conditions that later exist.

The road built in 1905 at Jacksonville, Fla., is a good illustration of this change. At that time the country was sparsely settled and no great amount of traffic went over the road. When it was completed, it was the best road around Jacksonville, and traffic, whenever possible, was diverted from other roads to it. In a year the travel over it had increased fourfold. A brickyard was established by the road and many very heavy loads were hauled over it. As Jacksonville has grown, the road now carries city traffic. Automobiles have increased in number from 100 in 1905 to 973 in 1910.

The value of maintenance is well illustrated on the Cumberland Gap-Tennessee-Virginia-Kentucky road. The entire road was built in a similar manner and the condition of the road over its entire length should now be the same, but this is far from being the case. The Kentucky section has been well maintained and is in excellent condition, while the Virginia-Tennessee section has received very little attention; the side ditches have not been properly cleaned out, and, as a result, in any instance where a seep occurs on the upper side of the road, the foundation has become softened and the surface of the road irregular. On account of the road being built in a side-hill cut, with a grade of about 7 per cent, systematic maintenance is imperative and any neglect of it is shown immediately by the rapid deterioration of the road.

Almost without exception, no improved roads had been built at any of the places inspected prior to the building of the object-lesson roads. In fourteen of the twenty-eight places the improvement of roads continued and 730 miles have been built. Bonds also in the amount of $1,500,000 have been issued. In the other fourteen places, while no surfaced roads have been built, owing principally to the lack of funds, a decided improvement was found in the work done upon the dirt roads.

It is the intention of the Office to inspect all the object-lesson roads that have been built as soon as it is possible to do so. The demand for engineers to build object-lesson roads has been so great that every available man has been so employed, and the inspections made this year were of those roads which were most conveniently located.

CULVERTS AND BRIDGES.

With the constantly increasing attention that is being given to the improvement of the public highways, there is also being made more apparent each year the need for better and safer highway bridges and culverts. Many of these structures have in the past been built of timber, which is short-lived under such conditions of service and is

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now constantly increasing in price, so that the cost of maintenance is excessive, in addition to the fact that the structures are unsatisfactory.

Many inquiries have been received concerning the construction of more permanent and economical structures, but up to the present time such information has not been available from any source in satisfactory form or amount. This Office is now collecting data along these lines and it is hoped to have much soon that will be extremely valuable on this subject.

MODEL COUNTY ROAD SYSTEM.

LAMAR COUNTY, TEX.—The work in Lamar County, Tex., precinct No. 1, consisted of examining the topography and soils, available road materials, nature of the products produced and hauled to market, and the population and wealth in their relation to a proposed bond issue. Precinct No. 1 has a population of 18,000 and an assessed valuation of $15,000,000. A system of roads was laid out which would meet the requirements of a great portion of the population and an estimate made of its cost, which was $300,000. A bond issue of this amount was then advised. General recommendations for carrying on the construction work were made and general specifications were drawn up for the work to be done.

MEDFORD, OREG.—The work of planning a system of roads and trails for the Crater Lake National Park, of making plans and specifications for a road from Medford, Oreg., to the park, and of planning and supervising the construction of a road through a portion of the Crater Lake National Forest was begun on April 4, 1910. This work was not completed at the end of the past fiscal year, and a detailed report will be given in the next annual report.

KALAMAZOO COUNTY, MICH.—Upon the request of the board of county commissioners of Kalamazoo County, Mich., two engineers were assigned by this Office to make a thorough inspection of the roads of that county and the system of management and methods of construction and maintenance in force. The engineer in charge reached Kalamazoo on March 28, 1910, and was later joined by an assistant engineer. This work had not been completed at the close of June 30, 1910, but good results had been accomplished through the introduction of better methods of construction and the substitution of gravel of a better grade than that previously used. Convict camps were established, equipped, and put in good order. The Office aided the local authorities in surveys and estimates. The progress in the work is indicated by the fact that a report made September 4, 1910, shows that 16 miles of road have been completed since this work was begun, and that 9 miles or more were under construction by contract, 2 miles by prison labor, and 6 miles by hired labor. The local road builders are being thoroughly instructed, so that the work will continue after the departure of our engineers.

ROUTINE TESTING OF ROAD MATERIALS.

There were received during the fiscal year 1910 1,168 samples of material to be tested, an increase of 433, or 59 per cent, over the number of samples received in the fiscal year 1909. Of this number,

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154 were tars, oils, and other dust preventives and road preservatives, 114 were limestones, 67 each of granites and sandstones, and 172 trap rocks; while the remainder consisted of almost every known road material, including 46 samples of slag. The Office has been making a thorough investigation of slag during the year, and has ascertained much in regard to its road-building qualities. Through official request this Office received and tested 160 samples of rocks from England for the road authorities of Great Britain. We have also received and tested 162 rock samples from the state geologist of the State of Washington. The samples received have come from forty States and Territories of the United States, from the District of Columbia, from Cuba and Porto Rico, from Canada, and from England. Among the States sending in samples, those sending the largest numbers have been: Washington, 164; Pennsylvania, 70; Georgia, 63; and New York, 52. A great many samples of materials have been tested in the District of Columbia, sent in through some one of the government offices and amounting to about 220 in all. Of the last number, 105 samples were tested for the Isthmian Canal Commission and consisted chiefly of rubber hose to be used in the canal construction. Samples have been tested at the request of the state highway commissions and state geological surveys of Delaware, Illinois, Louisiana, Maine, Michigan, Minnesota, New York, Oklahoma, Pennsylvania, Virginia, and Washington, the engineering department of the District of Columbia, the park commissioners of Chicago, and the city officials of eight other cities, besides the county officials of numerous counties throughout the country. In addition to these, the Office has tested a large number of materials for different branches of the United States Government, both in the District of Columbia and in the field, such as the Reclamation Service, the United States Geological Survey, the Bureau of Chemistry, and the Isthmian Canal Commission, as mentioned above. The Baltimore and Ohio Railroad, the Pennsylvania Railroad, and the Cleveland, Cincinnati, Chicago and St. Louis Railway have also had a number of samples tested in this Office for them.

INVESTIGATION OF DUST PREVENTIVES AND ROAD BINDERS.

During the past year the work of the Office relative to the investigation of the problems of dust prevention and road preservation has advanced rapidly, and many useful data have been secured which have been of great practical benefit to those who have sought information on this subject. It should be said that the desire for such information is almost universal among road builders, and that at present the great majority of settled communities in this country are facing the realization that rapid destruction of their roads under modern traffic is inevitable unless immediate and active measures are taken to meet these problems. Letters are being constantly received by the Office from all parts of the country asking for advice regarding the character and method of the application of dust preventives and road binders best suited to meet local requirements. To furnish such advice it has become necessary to increase both the working force and equipment of the chemical laboratory and to harmonize it with the Division of Engineering in such a manner that the two, while separate divisions, will act as a single working unit. The manner in which this has been accomplished will be shown in the following description of the work of the laboratory.

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During the past fiscal year the working force of the laboratory was increased by the appointment of two assistant chemists who had qualified for these positions under a civil-service examination dealing mainly with the chemistry of the bitumens. The quarters of the laboratory in the new building consist of an office, two modern chemical laboratories, and a petrographic laboratory. The permanent equipment of the laboratories is thoroughly up-to-date and the best that could be obtained for the limited amount of money available for this purpose.

It has invariably been the policy of the Office to broaden the experience of its employees to the fullest extent consistent with an economical administration of its duties. Thus the engineering force is given a course of instruction in the laboratories and each engineer is encouraged to familiarize himself, both through lectures and laboratory tests, with the chemical and physical properties of the materials which he has or will have occasion to use in practice. In like manner the laboratory men are allowed to inspect and assist in the experimental treatment and construction of roads with various types of dust preventives and road binders in order that they may obtain a thoroughly practical idea of the value of their laboratory work and, through a study of results, be enabled to modify and improve their methods of examination, and intelligently to investigate certain phases of the work which would be impossible for men confined solely to laboratory analysis. The wisdom of this policy has been made manifest in many ways, among which may be mentioned the advance made in regard to specifications for bituminous dust preventives and road binders to be used under various known local conditions.

Routine tests or analyses of bituminous road materials made in the chemical laboratory during the past year numbered 154, over double the number examined during the preceding year. Of these, 61 were tars, 72 oils and asphaltic preparations, 3 bituminous emulsions, and 18 rock asphalts and bituminous aggregates. The total number of routine tests, including the examination of materials other than bituminous, amounted to 167, excluding the petrographic analyses of rocks, which are reported among the physical tests. A number of these examinations were made in conjunction with experimental field work of the Office, and were reported, together with descriptions of these experiments, in Circular No. 92. It is expected that these examinations will be of great service in determining the value of certain classes of binders.

Through its laboratory work the Office has been able to offer valuable advice in regard to specifications for bituminous road binders and in many instances to frame such specifications upon the request of various public-service bodies. This opportunity has been used by a number of the state highway commissions, among which may be mentioned the highway commissions of Maine, New Jersey, Delaware, Illinois, and Iowa. In the District of Columbia practically all of the bituminous materials employed in the treatment of roads under the jurisdiction of the Office of Public Buildings and Grounds are examined and selected in accordance with specifications furnished by this Office.

Many worthless road preparations have been and are at present being manufactured and sold to the public through ignorance on the part of both producer and consumer with regard to the requisite

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characteristics of such materials to meet local conditions. These materials are sold under trade names, and as a rule carry no valid guaranty of quality. Specifications for such materials are therefore needed for the protection of the public, and this phase of the work will be given continued attention by the Office. Some manufacturers have already followed the work of the Office along this line, and are either manufacturing materials in accordance with specifications of the Office or stand ready to do so upon request.

Among the special investigations of bituminous road materials carried on by the laboratory may be mentioned improvements in methods of analysis, the effect of various methods of distillation upon the physical and chemical properties of tars, and the development of a test for determining the binding value of bitumens. The Office is cooperating in these matters with various technical societies, such as the Permanent International Association of Road Congresses, the American Society for Testing Materials, and the American Society of Civil Engineers. Among the papers which have been published along these lines during the past year may be mentioned Circular No. 92, United States Office of Public Roads, concerning the physical and chemical characteristics of bituminous road materials, and the determination of soluble bitumens.

INSTRUCTION IN HIGHWAY ENGINEERING.

The plan of appointing graduates of the leading engineering institutions to the position of civil engineer student in this Office has been continued throughout the fiscal year along the lines previously followed. An examination was held March 9–10, 1910, under the auspices of the Civil Service Commission, and an eligible register established from which seven engineer students were appointed during the fiscal year 1910.

As evidence of the demand for competent highway engineers throughout the country, and the extent to which the engineers of this Office are being utilized to meet this demand, it may be stated that during the past fiscal year eight engineers have resigned from the service to take up road work in various parts of the country.

LECTURES, ADDRESSES, AND PAPERS.

The work of the Office under this project, comprising in all 523 lectures, addresses, and papers, was distributed over a wide range of territory, embracing the States of Alabama, Arkansas, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, Nebraska, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, and West Virginia, and the District of Columbia. A large proportion of the addresses was given at farmers' meetings in small towns and villages, but the work included a great many lectures and papers before scientific organizations and conventions of road builders and road officials. In view of the fact that the widespread dissemination of information is essential to the betterment of road conditions, it is believed that giving lectures of a practical character is productive of excellent results.

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INSPECTION AND ADVICE.

The advisory work of the Office consisted of 242 assignments during the past year, which may be classified as follows: Advice in regard—

(1) To various methods of road construction, including macadam, gravel, earth, sand-clay, burnt clay, bituminous, slag, brick, and oiled earth.

(2) To surveys for proper location of roads.

(3) To the use of convicts on roads and housing them during the continuance of the work.

(4) To preliminary inspection of conditions and location of roads where object-lesson roads are requested.

(5) To new methods of construction to be used experimentally.

(6) To the treatment of driveways at the Washington Indian School, Puyallup, Wash.

(7) To the construction of bridges.

(8) To oil-concrete flooring for bridges.

(9) To devising model systems of roadways for counties, and the best methods of construction, maintenance, and administration.

(10) To the destructive effects of automobiles on roads.

(11) To bond issues for raising funds for road construction.

(12) To the use of the split-log drag.

(13) To the investigation of road materials.

(14) To the use of concrete on farms.

This branch of the work is constantly growing in importance as the corps of engineers, chemists, and experts of the Office is now looked upon as a high-grade body of consulting specialists from whom reliable advice may be procured concerning difficult and peculiar problems such as are not capable of easy solution by local authorities.

STATISTICAL AND ECONOMIC INVESTIGATIONS.

In November, 1909, an investigation was begun to ascertain the present status of road improvement in the United States. The cooperation and assistance of state highway officials and of county and township officials was sought in this undertaking. In six States the state highway departments have promised to collect the necessary data; in all of the other States the county and township officials have had to be relied upon for procuring information. Questions were sent to each county requesting data as to the number of miles of each type of improved roads therein, the cost per mile of such roads, and whether bonds had been issued or authorized for road purposes. In many instances immediate replies were received to these questions, but in a majority of cases a second and sometimes a third and fourth set of questions were required. However, at the close of the fiscal year, practically complete returns have been received for about one-fourth of the States. On receipt of complete returns, reports for each State are being sent, when practicable, to some state highway official, or other competent state official, for verification. This consumes considerable time and necessarily delays the work to some extent. It is the purpose of the Office to publish the results of this investigation as a supplement to Bulletin No. 32, which was issued in 1904, and it is expected that the work will be completed and the bulletin ready for publication by January 1, 1911.

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On November 1, 1909, an engineer from the Office, accompanied by the Office photographer, left Washington on an extended tour, for the purpose of securing photographs and other data concerning road construction and maintenance throughout the territory covered. The object of this tour was to collect information for use in reporting the results of certain object-lesson and experimental work which had been conducted by the Office and for illustrating certain contemplated publications, and also to afford a source of information from which the engineers of the Office could post themselves as to the conditions existing in those sections of the States visited, before entering upon any highway work therein. This tour covered the period from November 1, 1909, to January 8, 1910, and much valuable data was obtained. It was not intended that the results of this investigation should be published separately, but that they should be for use as above outlined.

Another very important investigation was begun to ascertain the economic effect of road improvement upon communities. In this work counties which had voted to issue bonds for road purposes were selected in different sections of the country and, before the bonds were issued or the work of improvement begun, a careful study of the agricultural and road conditions was made along the line of the roads to be improved. The following facts, illustrated by photographs, were ascertained: The value of the land; the character of the crops hauled to market; the size of the loads; the distance to the market; the cost of marketing the crops; the area of productivity of the different crops; the condition of the schools and farm life; the efficiency of the rural mail delivery service; railroad statistics of incoming and outgoing freights at the points of investigation. This investigation was begun in January, 1910, and will cover a period of several years, since it can not be completed until the proceeds of the bonds have been expended and the effects of the improved roads noted. After the roads are completed, it is proposed to examine them again and note the beneficial effects which the improvements have had upon conditions, illustrating these facts by new photographs. The information obtained by this investigation is intended for publication as a comprehensive bulletin, showing the economic value of road improvement.

INVESTIGATIONS OF SLAG AND CEMENT.

The work carried on in the petrographic laboratory embraced, besides the usual routine examination of rocks for road making, an extensive study of blast-furnace and open-hearth slags and Portland cement clinkers to determine their road-making qualities. The work is essentially a continuation and extension, under more favorable circumstances, of that of last year and the results have been proportionately greater.

Samples of basic open-hearth slag have been obtained from the larger steel mills of the country and the laboratory investigations have demonstrated that practically all of them are well adapted to road construction, especially when used as binding material. These conclusions have been amply confirmed by actual service tests, as in the case of the experimental slag roads constructed last year under the auspices of the Office, at Youngstown, Ohio, and Ithaca, N. Y.

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It is expected in the following year to continue the study of this class of road material with the view of determining accurately the water-soluble portion, which will demonstrate the relative value of these slags from a road-making standpoint.

The addition of quicklime to basic blast-furnace slag screenings has proved effective in the field experiments in increasing the cementing properties and consequently the value of this class of road binders.

The investigations of Portland-cement clinkers have been undertaken in connection with the study of basic open-hearth slag to throw light, if possible, on the hydraulic properties of the latter material. Samples of clinkers from the more important cement mills have been examined microscopically, and the effect of water upon them has been carefully recorded. This work will be continued in the following year in conjunction with the slag investigations.

CORROSION OF IRON AND STEEL.

In the last annual report of this Office the results obtained in the research work that has been carried on for a number of years on the corrosion of iron and steel were described. A great deal of progress has been made along these lines recently. As an instance of this may be noted the improvements that have been made in corrugated-iron culverts for road building and general drainage purposes. The investigations carried on in the Office have led to the preparation by manufacturers of very much purer metal than has previously been obtainable for the manufacture of culverts and pipes. In fact, following the recommendations of one of our representatives, a number of manufacturers are now turning out metal in great quantities which is almost entirely pure iron at a very slightly advanced cost over the ordinary steels. There is every reason to believe that these purer irons are going to be of great service, for, although it is not possible to make an iron that is entirely rust-proof, the pure irons do not rust as rapidly or form pitholes as quickly as in the case of more impure metals.

As everyone knows, there have been great complaints during the last ten years in regard to the quality and rust-resistant power of wire fencing. This Office has taken this matter up and made a thorough study of it. The representative of the Office has obtained the cooperation of some of the leading and most influential manufacturers in the country. Investigations showed that much of the wire fencing was not only made of inferior material, but that the galvanizing was put on very thin. Since the investigations have been going on it is safe to say that a great improvement has been made by some of the manufacturers, who now seem willing to do everything they can to improve their products. One of the methods that is now in use for determining the amount of zinc that is carried by wire depends upon dipping samples into a strong solution of copper sulphate. This action destroys the zinc that covers the iron in a very short time, and, by measuring the time that it takes to destroy the coating, it is possible to obtain an idea of how heavily the wire is coated. Several years ago it was hardly possible to find galvanized fence wire in the open market which would stand one minute in this solution. At present a great deal of the wire that

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has been tested will stand two full one-minute immersions. Wire is graded and spoken of as "one-dip," "two-dip," "three-dip," or "four-dip," as the case may be. As a result of the activity of the representative of this Office, it is now possible to buy from the leading manufacturers "three-dip" wire, which will undoubtedly last very much longer than the ordinary "one-dip." From the facts, as far as there has been time to gather them, it would appear to be somewhere near the truth to state that "two-dip" wire will last, under ordinary conditions, twice as long as "one-dip," "three-dip" three times as long, etc. "Four-dip" is mainly used for telephone and telegraph lines, and it has not yet been found practicable to make it into farm fences, owing to the fact that such heavy zinc coatings are apt to crack and break off in structures where sharp bends of the wire are necessary. An article describing the present state of affairs with regard to wire fencing appeared in the Yearbook of the Department of Agriculture for 1909. It is, of course, true that a slightly higher price is asked for the very highly protected wire, but as the price does not rise in proportion with the probable increased length of the life of the wire, its purchase will be economical for those who desire to build well for the future.

The investigations have also been extended to the protection of various structures of iron and steel by the use of paints, and it is not an exaggeration to state that the entire science of protective paints has been put on a firmer foundation, owing to the investigations carried on in the Office of Public Roads. For the first time it is possible to design and specify a protective paint which will not only cover the metal, but will act as a deterrent to rusting, in case water and the atmosphere penetrate to the surface of the underlying steel. It has been shown that the life of wire fencing can be prolonged, and it has been estimated that the ordinary farm fences can be painted at an expense of about 1 cent per rod. If properly selected and designed, there is no doubt that the farmers can protect their wire fencing for many years at a comparatively small expense and with little trouble, since the painting can be done at those seasons of the year when the farmer is not especially occupied with plowing, planting, or harvesting.

OIL-CEMENT CONCRETE.

Perhaps the most important development that has attended the investigative work of the Office during the past year has been the development of oil-cement concrete. It is very well known that Portland cement concrete is rapidly becoming a universal building material. It is not only used in road building, but in all forms of engineering construction as well as in the construction of buildings of all sorts. Its use on the farm has been very much extended, and it is probable that in the not very distant future reinforced concrete will be used in the construction of farm buildings, including dwellings. The principal objection to the present use of cement concrete as a material of construction lies in the fact that it is extremely porous and absorbs water. On this account, it is well known that buildings constructed of concrete are damp. There are on the market a number of patented and secret water-proofing materials, but none of these, we believe, has given satisfactory results under the varied conditions of service.

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In the course of experimentation the discovery was made in the testing laboratories of the Office of Public Roads that it was possible to mingle mineral oils with the concrete while it was still wet and before it was laid or molded in the forms. This discovery has been made the subject of a very systematic investigation. A very large number of test pieces have been made containing varying quantities of different brands and types of oils, and a very large amount of useful information has been collected. The results of these systematic investigations will soon be published. In the mean time the work is already being taken up in a practical way in actual construction. Under the supervision of the Office, several road surfaces have been made of oil-cement concrete. One of these roads is located in New Jersey and another in the District of Columbia. In addition to this, a bridge surface has been constructed of this material in New Jersey. After being laid and in use for nearly a year, these surfaces have given successful results. The use of oil-cement concrete is, however, by no means confined to road-surface construction, for it can be used to replace ordinary cement concrete under almost all conditions. Floors, cellars, foundation walls, tanks, silos, manure pits, and similar constructions where strength, solidity, and waterproof qualities require to be combined can be to-day built out of oil-cement concrete.

In the investigations varying amounts of oil have been added, but the best results are obtained when the amount of oil used represents from about 10 to 15 per cent of the weight of the cement used in mixing the aggregate. The mixing presents no difficulties whatsoever, either when the concrete is mixed by hand with shovels or when a mechanical mixer of the revolving-barrel type is used. The method of mixing oil-cement concrete does not differ materially from that used in mixing ordinary concrete. The method followed is to mingle the proper quantities of cement, sand, and water, and, as soon as these have been given a preliminary mixing, a suitable quantity of the oil is added, followed by the gravel or broken-stone aggregate. The subsequent mixing presents no difficulties and takes very little longer than in ordinary work. Oil-cement concrete has been given a practical application recently in the construction of a series of new vaults at the United States Treasury. In this case a one-two-four mixture was used, that is to say, one part of cement, two of sand, and four of clean gravel. The oil used is known as Standard Flux 55 Maltha. The quantity of oil was 10 per cent of the weight of the cement used in the mixture. It is confidently believed that, in the course of time, as soon as engineers have assured themselves of the value of this form of construction, it will very largely replace the ordinary methods of reinforced concrete construction. The great advantages of oil-cement concrete lie in the fact that it is much more dense, entirely waterproof, and develops an ultimate strength of about the same order of magnitudes as concrete mixtures which do not contain any oil.

LIBRARY.

The library of this Office has grown considerably in the past few years and now contains an excellent collection of publications dealing with road construction and allied subjects. It is the aim of the library to secure copies of all recent publications on subjects con-

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nected with road construction, maintenance, and administration, and publishing houses have been very generous in their answers to the requests made for this purpose. The library now receives 47 periodicals, of which 14 are given to it by the publishers, while the others are received through the department library. Most of these publications are published in the United States, but among them are 4 French periodicals, 6 English, and 1 German. During the last fiscal year a very important line of library indexing has been started with regard to the periodical literature which is received. A very careful index is made of every article in each of these publications which is of any interest to the scientists of this Office. Copies of this index are sent to each of these scientists every month and a complete card index is kept and added to from time to time. This forms the nucleus of probably the most important information that is to be found in the Office.

OUTLINE OF PLANS FOR THE CURRENT YEAR.

It is not expected that the work of the current fiscal year will differ in any essential particular from the work of the last fiscal year. The experiments with various bituminous binders will be continued and broadened in scope and extent as facilities permit. The system for the collection, compilation, and dissemination of data relating to the progress of road improvement throughout the United States will be improved through the appointment of a special agent for each State, who will report, on the first of each month, the results accomplished during the preceding month. It is expected that gratifying results will be obtained through the experiments with oil concrete. Arrangements are being made for a comprehensive series of traction tests, supplementing those previously made.

The present quarters of the Office afford sufficient space and adequate arrangement to enable us to systematize our work during the current year to a far better advantage than at any time in the previous history of the Office.

PLANS AND RECOMENDATIONS FOR 1912.

The estimates for the fiscal year 1912 provide an increase of $51,660. It is proposed to establish a permanent field station for the testing of all road material and methods of construction, and to make continuous observations from year to year so that absolutely reliable data may be obtained. This field experiment station will consist of a road approximately 8 or 10 miles in length, in the vicinity of which will be erected suitable temporary storehouses and working quarters. The plan will involve the improvement of approximately 1 mile of the road each year with various materials, which will be applied according to various methods.

In the event that the increase is granted, it is expected to broaden the scope of the advisory work, the construction of object-lesson roads, and to provide an effective system for obtaining prompt and thorough reports of all road work in progress in the United States.

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REPORT OF THE SOLICITOR.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SOLICITOR,
Washington, D. C., Septembr 22, 1910.

SIR: I submit herewith the report of the work of the Office of the Solicitor for the fiscal year ended June 30, 1910.

Very respectfully,

GEO. P. MCCABE, *Solicitor.*

Hon. JAMES WILSON,
Secretary of Agriculture.

OUTLINE OF OFFICE WORK.

As stated in previous reports, the duties of the Solicitor of the Department are outlined in your General Order No. 85, dated June 17, 1905, which, in effect, constitutes the Solicitor the legal adviser of the Secretary and gives him supervision of all the law work of the Department of Agriculture. On January 15, 1910, your General Order No. 138 placed the law work of the Forest Service under the immediate direction of the Solicitor. Theretofore the law work of that branch of the Department, while conducted under my general supervision, was in the immediate charge of the law officer of the Service. In addition to a force of assistants in Washington, the law officer had under his direction law clerks stationed at Missoula, Mont.; Denver, Colo.; Albuquerque, N. Mex.; Ogden, Utah; San Francisco, Cal., and Portland, Oreg. On June 9, 1910, your General Order No. 140, effective July 1, 1910, was issued, supplementing General Orders Nos. 85 and 138; this order was made necessary by a provision in the agricultural appropriation act of May 26, 1910 (36 Stat., 416), which provides that "hereafter the legal work of the Department of Agriculture shall be performed under the supervision and direction of the Solicitor." This order gives in detail the legal work of each Bureau, Office, and Division of the Department which is placed in my charge.

The very marked increase in the volume of work in this Office during the past fiscal year, together with the further duties imposed by General Order No. 138, necessitated additional assistance and a complete reorganization of the force. In February, 1910, I visited in person each of the six district law offices in the field, which were formerly under the immediate supervision of the law officer of the Forest Service; a system of weekly reports to me was inaugurated, steps were taken to see that the legal advice given on similar questions in all the districts should be uniform, the details of office business were harmonized, and the entire legal work of these field offices was

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placed on a sound, businesslike basis. Later, the office force in the city of Washington was also reorganized and assembled under one roof.

As stated in the Annual Report for the fiscal year 1909, 928 cases were reported to the Attorney-General for action in the courts during that period; in the fiscal year 1910, 1,738 cases, or nearly double the number similarly reported in the same period last year, were transmitted to the Attorney-General. Of these cases, 990 were apparent violations of the food and drugs act of June 30, 1906 (34 Stat., 768), of which 766 were apparent violations of section 2, reported as a basis for criminal prosecution, and 224 formed the basis for seizure proceedings under section 10 of the same act. During the fiscal year 1909, 494 cases were reported to the Attorney-General for appropriate action under this statute. Fines were collected during the fiscal year 1910 in the sum of $11,049.31, as compared with $5,412 similarly collected in the preceding year; 175 seizure proceedings terminated in favor of the United States in 1910, as compared with 98 similar cases in 1909. In all, 15 cases (9 criminal cases and 6 seizures) terminated in favor of the defendants during 1910, as compared with 5 cases (2 criminal cases and 3 seizures) in 1909. In 6 cases leave to file information was denied, and in 3 cases the grand jury failed to return indictments. At the close of the fiscal year 1910, 470 cases (404 criminal cases and 66 seizures) were pending in the courts or in the hands of United States attorneys; at the close of the fiscal year 1909, 116 cases under the same statute were pending, 74 being criminal cases and 42 seizures.

The Office reported 438 violations of the twenty-eight hour law (act of June 29, 1906, 34 Stat., 607) in the fiscal year 1910, as compared with 208 cases similarly reported in 1909. Penalties aggregating $16,500 were recovered and costs in the sum of $2,919.35 were paid in 1910; in 1909, penalties in the sum of $73,490 and costs in the sum of $11,539.85 were assessed. One hundred and thirty-nine cases were disposed of during 1910, as compared with 617 cases during 1909; the greater number of cases tried in 1909 than 1910 will explain the fact that a larger amount in penalties was collected in 1909 than in 1910. In 1909, 33 cases out of 650 tried resulted adversely to the United States; in 1910, 19 cases out of 158 tried terminated in favor of the defendants. Three hundred and five cases were pending at the close of June 30, 1909, as compared with 559 pending at the close of June 30, 1910.

One hundred and forty-eight apparent violations of the live stock quarantine laws were reported to the Attorney-General during 1910, as compared with 169 cases during 1909. Of these, 140 were apparent violations of the act of March 3, 1905 (33 Stat., 1264), and 8 were apparent violations of the act of May 29, 1884 (23 Stat., 31). In all, fines amounting to $2,970 were collected in the 20 cases disposed of under these statutes during 1910, as compared with $3,400 collected in fines in the 30 cases disposed of during 1909. In one case, involving 5 alleged violations of the act of March 3, 1905, a verdict of guilty was returned and fines aggregating $1,000 and costs were imposed. On writ of error this case was argued before the circuit court of appeals for the eighth circuit, which has not yet handed down a decision.

Fifty-two violations of the meat-inspection amendment (act of June 30, 1906, 34 Stat., 674) were reported to the Attorney-General in 1910,

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as compared with 44 similar cases reported in 1909. Eighteen cases terminated in favor of the United States in 1910; fines were assessed in the aggregate of $2,397; 15 cases were disposed of in 1909, resulting in the collection of fines in the sum of $890. In one case during the fiscal year 1910 the defendant was fined $1,000 and sentenced to ten months in the house of correction, and in another a fine of $50 and a sentence of ninety days' imprisonment were imposed. No cases were lost, 8 were dismissed for lack of evidence, and 26 were pending at the close of June 30, 1910; no cases were lost in 1909, 7 were dismissed for lack of evidence, and 22 cases were pending at the close of June 30, 1909. Property of the Department, unlawfully detained by cooperative Weather Bureau observers, was recovered in two cases in 1910 and in three cases in 1909. Two employees of the Department were indicted for falsifying their expense accounts and will be tried this fall. The indictments charged offenses under sections 5392 and 5438, Revised Statutes. Four hundred and nine agreements and 87 bonds were prepared in 1910, as compared with 702 agreements and 58 bonds in 1909; the General Supply Committee, for all the Departments, prepared, in the fiscal year 1910, a large number of the agreements which would otherwise have been prepared in this Office. Disregarding these agreements, a substantially larger number of contracts and bonds was prepared in 1910 than in 1909. Nine applications for letters patent on inventions of employees of the Department, for dedication to the public, were filed in 1910, as compared with 7 in 1909; 5 patents were allowed and 1 disallowed in 1910, as compared with 4 patents allowed and 1 disallowed in 1909. No count has been kept of the number of memoranda, in the form of briefs, transmitted to United States attorneys, for use in connection with the preparation of formal briefs or in arguments, before the courts in connection with cases in which this Department was interested. It is the practice of this Office to cooperate fully with the United States attorneys, upon request, in searching for authorities and in the formulation of arguments to support the contentions of the Government wherever this becomes necessary in the trial of cases arising under acts of Congress intrusted to the Department for administration.

As stated, since January 15, 1910, the law work of the Forest Service has been under my immediate direction. A detailed statement of the work done in this connection appears elsewhere in this report. Some idea of the large volume of work handled is conveyed by the statement that 105 cases of apparent violations of the acts passed for the protection of the National Forests were reported to the Attorney-General for appropriate action in the period from January 15, 1910, to June 30, 1910. Fifty-one written opinions were rendered to officers of the Forest Service on the legal phases of questions arising in the administration of the National Forests. Fifty-three agreements, 150 leases, and 47 bonds were prepared during the same period on behalf of the Forest Service. Five hundred and sixty-five cases of contested claims to lands within the National Forests, initiated under the public-land laws, including the homestead and mining laws, were disposed of during the same period by the branches of this Office in the field. In addition to such work on behalf of the Forest Service as may be assigned them by the Solicitor, these branch offices in the field also handle law work on behalf of the other Bureaus, Offices, and Divisions of the Department, under his direction.

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The litigation in which this Department is concerned presents a number of issues, highly important and interesting, which will be passed upon by the courts in the near future. Two cases arising under the twenty-eight-hour law, 2 under the food and drugs act, and 1 case under an act passed for the protection of the National Forests will be argued before the Supreme Court of the United States this fall; in addition, several noteworthy cases will be tried before the courts of the District of Columbia and argued before the circuit courts of appeals for different circuits.

It is extremely difficult to convey an adequate idea of the volume and character of the work of this Office in statistical form. The foregoing brief survey of the legal business transacted shows that our duties have practically doubled, since the publication of the Annual Report for the fiscal year 1909, in respect to the enforcement of the food and drugs act alone, to say nothing of the additional work being performed for the Forest Service and the normal expansion along other lines of activity. At the last session Congress enacted the insecticide law (act of April 26, 1910; 36 Stat., 331), effective January 1, 1911, which will materially add to our labors. It is, of course, true that additional assistance has been provided, from time to time, but the present force is barely sufficient to keep the work up to date, even with the constant expenditure of extra time.

It should be noted that in the following report no reference is made to any case, in tabular form, nor is the name of any defendant stated, unless an indictment has been returned or an information has been filed in the case. The only reference to such cases is in the general summary, where the statement is made of the number of cases transmitted to the Attorney-General for appropriate action.

ADMINISTRATION OF ACTS OF CONGRESS.

THE FOOD AND DRUGS ACT.

Important progress has been made during the year in the enforcement of the food and drugs act of June 30, 1906 (34 Stat., 768). Experience has developed new methods of handling reports of violations, from the time samples are collected up to the time the evidence is furnished to the Department of Justice. The results appear in the increased number of violations reported and in the increased number of convictions obtained in the courts. The volume of work of the Office in this connection more than doubled during the past fiscal year. About 1,000 cases were reported during that time, in each of which the evidence was carefully weighed. A considerable number of letters, in the form of memoranda or briefs, have been prepared on important questions arising under the act, covering the interpretation of the provisions of the law and questions of procedure. Early in the year, at the request of this Department, instructions were issued to United States attorneys requesting them to proceed in cases under section 2 of the act by information rather than by indictment. This practice is generally followed and results in facilitating the prosecution of the cases, as well as in a considerable saving to the Government in the expenses and time of witnesses, who would otherwise be compelled to appear before the grand jury as well as at the trial of cases. Full cooperation exists between the Department of Justice and this Depart-

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ment; the success obtained is believed to be due, in good part, to the free interchange of views with the prosecuting officers of the Government.

As hereinbefore stated, at the close of the year General Order No. 140 was issued by you, which will increase largely the duties of this Office in connection with the food and drugs act, and is designed to increase the efficiency of the Department in the work incident to its enforcement. The order was issued to give effect to the act of Congress which directs that the legal work of the Department shall be performed under the direction of the Solicitor, and requires the Solicitor to examine the reports of the Bureau of Chemistry showing the results of the examination of samples of foods and drugs and to recommend to the Secretary whether citations shall issue and the parties to be cited. After hearings have been held under the supervision of the Board of Food and Drug Inspection, the Solicitor is required to examine the evidence at hand and to recommend to the Secretary whether the cases shall be reported for prosecution, and if the Secretary determines on such action to prepare the cases for reference to the Attorney-General. Under the order the Solicitor is further directed to make recommendations to the Secretary in the case of all seizures proposed by the Board of Food and Drug Inspection to be effected under section 10 of the act, and to exercise a general supervision over the preparation of all food-inspection decisions issued from time to time. Notices of judgment, provided for by section 4 of the act, will be prepared in the Office of the Solicitor as heretofore. During the fiscal year 1910 the recommendations to you of action to be taken in food and drug matters were made by the Board of Food and Drug Inspection. A considerable part of the Solicitor's time was devoted to the work of the Board, including the consideration of cases reported by the Bureau of Chemistry, the drafting of food-inspection decisions, the conduct of hearings, and the supervision of the voluminous correspondence of the Board.

The act provides two forms of procedure. The one is a criminal prosecution against shippers in interstate commerce, or the vendors in the Territories and the District of Columbia, of adulterated or misbranded foods and drugs. The other is a proceeding, by way of libel for condemnation and forfeiture, against consignments of adulterated or misbranded foods and drugs found in the channels of interstate and foreign commerce or offered for sale in the Territories and the District of Columbia. Seven hundred and sixty-six cases were reported to the Attorney-General for criminal prosecution. Of these, 246 resulted in convictions. In by far the greater number of these cases the defendants pleaded guilty. The comparatively small number of contested cases generally terminated favorably to the Government. Of the total number of these criminal cases, but 8 resulted in favor of the defendants. Fines were imposed in criminal cases amounting to $7,858, and costs were assessed against the defendants in equal or greater amount. Ninety-six were dismissed on the recommendation or with the concurrence of the Attorney-General or the United States attorneys to whom the cases were referred for prosecution. The evidence available at the time in each criminal case was carefully weighed before the case was reported, and, with a very few exceptions, each one presented a substantial violation of the law. Subsequent investigations by United States

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attorneys in some cases and by the Department of Agriculture in others, developed mitigating circumstances which led to their dismissal or discontinuance. In a few cases it was found impossible to obtain service on defendants who had left the jurisdiction. A few other cases were dropped, because it was found impossible to produce satisfactory evidence to establish the interstate shipment of the particular product on account of the death of necessary witnesses. In no case has leniency been shown or recommended to the shippers or vendors of foods unfit for consumption or deleterious to health, or of adulterated and misbranded products containing dangerous and habit-forming drugs. Convictions were obtained against the shippers of filthy egg products, alleged manhood restorers, olive oil heavily adulterated with cotton-seed oil, flavoring extracts containing wood alcohol, proprietary medicines for which false claims were made on the labels, short-weight canned and bottled goods, maple sirup mixed with cane or corn sirups, pepper adulterated with foreign material, skimmed, watered, and filthy milk, etc.

Of the whole number of criminal cases reported during the year, 152 were pending in the courts at its close. There were also 252 cases in the hands of the Attorney-General or the United States attorneys for consideration and presentation to the courts during the coming year.

Seizure was effected during the year of 224 shipments of adulterated and misbranded foods and drugs. Decrees of condemnation and forfeiture were rendered against 132 of these shipments, and proceedings were pending at the close of the year in 50 cases of this class. In 6 seizure cases proceedings were abandoned because the goods could not be found or had passed beyond Federal jurisdiction. Six seizures were dismissed because of insufficiency of evidence. Hundreds of tons of merchandise were forfeited to the use of the United States during the year. In cases where the adulteration or misbranding of the product could be cured by relabeling, the goods generally have been released to the claimants on the filing of bonds satisfactory to the court that they would not be sold or otherwise disposed of contrary to law. On the other hand, numerous shipments of food products have been destroyed by direction of the courts, when the product was found to be filthy, decomposed, or putrid, or to contain substances deleterious to health. There is no cure for these forms of adulteration. Large quantities of filthy egg products have been destroyed in various sections of the country. In the northern district of Illinois several hundred cases of macaroni, containing a poisonous color, were condemned, and judgment was rendered in the eastern district of Pennsylvania against several barrels of filthy and decomposed black olives. Many carloads of flour bleached with nitrogen peroxid, a poisonous substance, were seized during the year. A decree of condemnation and forfeiture adjudging this product to be adulterated and misbranded was rendered in the United States district court at New Orleans, in a case which was not contested on its merits. A second case vigorously contested, involving this product, was on trial at the close of the year in the western district of Missouri. The jury returned a verdict for the United States in July, and a decree of condemnation and forfeiture was entered. The claimants noted an appeal and the case is pending before the circuit court of appeals for the eighth circuit.

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Libel was filed in the eastern district of Pennsylvania against 1,200 bags of green coffee, and adulteration alleged on the finding of the Department's analysts that the product was filthy, decomposed, or putrid. Judgment was rendered in favor of the claimant, the court holding that evidence offered was insufficient to support the allegations of the libel.

There were also terminated during the year 60 criminal cases reported during previous years. Fines were imposed in these cases amounting to $2,701.31.

Decrees of condemnation and forfeiture were rendered in 43 seizures effected during previous years. In all, the amount of fines imposed during the year 1910 in criminal cases was $11,049.31, and 175 decrees of condemnation and forfeiture were rendered.

In addition to the above, important suits arising out of the enforcement of the act were terminated favorably to the Government. In one proceeding bills in equity were filed in the southern district of Iowa, praying that the United States attorney, the United States marshal, and an inspector of the Department of Agriculture be restrained from making further seizures of flour bleached by the Alsop process. The defendants filed demurrers to the bills of complaint, and the questions of law were fully argued to the court. (Shawnee Milling Co. *v* Temple et al., 179 Fed., 517.) Complainants' bills were dismissed, and the court rendered an opinion upholding the constitutionality of the act and the right of the Government to seize flour bleached by the Alsop process. Two suits instituted for the recovery of the penalties of bonds filed by claimants of goods condemned and forfeited to the United States and released to them under the provisions of section 10 of the act resulted in judgment in favor of the United States. The bill filed in the previous year by the Hipolite Egg Company, in the supreme court of the District of Columbia, praying that the Secretary of Agriculture be restrained from further enforcement of the food and drugs act, and in which a rule to show cause why an injunction should not be granted was pending, was dismissed by the petitioners.

While the great majority of cases arising under the act up to the close of the year were uncontested, certain important principles have been established in the comparatively small number of cases in which defendants or claimants have taken issue with the Government.

The constitutionality of the act has been attacked and upheld by the courts in the following cases:

United States *v.* 100 Cases of Tepee Apples and 172 Cases of Tepee Blackberries. Western district of Missouri, Notice of Judgment No. 36. (179 Fed., 985.)

United States *v.* 300 Cases of Mapleine. Northern district of Illinois, Notice of Judgment No. 163.

United States *v.* 420 Sacks of Flour, eastern district of Louisiana, Notice of Judgment No. 382. (180 Fed., 518.)

Shawnee Milling Co. et al, complainants, *v.* Marcellus L. Temple, United States attorney, et al., southern district of Iowa. Notice of Judgment No. 497. (179 Fed., 517.)

United States *v.* Edward Westen Tea and Spice Co., eastern district of Missouri, Notice of Judgment No. 194.

United States *v.* Buffalo Cold Storage Company, western district of New York, Notice of Judgment No. 482. (179 Fed., 865.)

In United States *v.* Charles L. Heinle Specialty Co., tried in the eastern district of Pennsylvania (Notice of Judgment No. 389, Circular No. 29, Office of the Solicitor), section 9 of the act was held to be constitutional.

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The Heinle Specialty Company sold and delivered to the Merchants Grocery Company at Philadelphia a quantity of adulterated and misbranded vanilla extract and at the time of sale gave to the Merchants Grocery Company a signed guaranty to the effect that the extract was neither adulterated nor misbranded within the meaning of the food and drugs act of June 30, 1906. The Merchants Grocery Company shipped this extract in interstate commerce. Samples were obtained and examined, and after it was found that the extract was adulterated and misbranded a criminal information was filed against the Heinle Specialty Company alleging that the defendant at the time of making sale and delivery of this product knew that the extract was likely to be sold in interstate traffic and that the interstate shipment thereof was unlawfully made, and that by reason of the guaranty given said defendant was amenable to the prosecutions, fines, and other penalties which attached because of the unlawful shipment. The defendant filed a demurrer to the information, and the court after hearing argument rendered an opinion overruling the demurrer and sustaining the validity of the guaranty section of the act.

The guaranty section of the act was also drawn in question in United States *v.* Mayfield et al. (177 Fed., 765; Notice of Judgment No. 326). In this case the Birmingham Celery Cola Company shipped in interstate commerce a food product labeled "Celery Cola." Examination of samples showed the product to be adulterated because it contained cocaine, cocaine derivatives, and caffeine, held to be deleterious and poisonous ingredients. The product was also misbranded because the quantity or proportion of cocaine present was not declared on the label. Criminal information was filed against the officers of the corporation and a jury trial was had. The defendants denied responsibility for the shipment, and further relied, as a matter of defense, on a guaranty given by the makers of the extract from which the Celery Cola was manufactured that the extract was not adulterated or misbranded under the food and drugs act. The court, in charging the jury, said that the guaranty provided by section 9 of the act is available to a dealer only when such guaranty relates to the identical article shipped by him and affords no defense to him when the guaranty relates only to a constituent used by him in manufacturing the article shipped; and further, that the officers of a corporation which manufactured an adulterated or misbranded food product shipped by its manager in interstate commerce are subject to prosecution therefor when they authorized the manager to operate the plant and sell the product without restriction, and the previous course had been to ship on orders to other States. The jury returned a verdict of guilty as to two officers of the corporation and fines were imposed on each.

A decision adverse to the contentions of the Government was rendered in United States *v.* Sixty-eight Cases of Sirup (172 Fed., 781; Notice of Judgment No. 283). In that case libel was filed against 68 cases of sirup labeled (on cases) "Western Reserve Ohio blended maple syrup guaranteed absolutely pure, shipped by Western Reserve Syrup Co., Cleveland, Ohio;" (on bottles) "Western Reserve Ohio blended syrup, Western Reserve Company, Cleveland, Ohio, blenders of fancy maple syrup and maple sugar," and misbranding was alleged for the reason that the labeling was misleading and deceptive because

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the bottles did not contain maple sirup nor a blend of maple sirup, but did contain a mixture or compound composed largely of refined cane sugar flavored with extract of maple wood. The claimant demurred to the libel and, after hearing, the demurrer was sustained. In its opinion the court held that the labels conveyed the impression that the product was a blended sirup, and further, that the sirup was in fact a blend and within the exception provided by the fourth paragraph of section 8 of the act in the case of blends. This exception provides that articles of food will not be deemed to be misbranded if labeled or branded so as to indicate that they are blends, and the word "blend" is plainly stated on the label. The term "blend" is defined to mean a mixture of like substances, not excluding harmless color or flavor used for the purposes of coloring and flavoring only, and the court said that the manufacturers in the present case had produced the very blend contemplated by the exception by adding to cane sugar the flavoring extract of maple wood, and added that the labels in question were not misleading, because the word "blend" in itself indicates a mixture or an imitation.

This Department is unable to accept the view that cane sugar flavored with extract of maple wood is a "blend" within the meaning of the food and drugs act, and on receipt of notice of the decision in this case desired to have it reviewed on appeal. It developed, however, that the sirup had been released to the claimants and as the res had passed out of the jurisdiction of the court, an appeal was deemed by the Attorney-General to be inadvisable. It is regrettable that the opinion could not be reviewed, since the Department is strongly inclined to think that it does not state the law. This is so because the product was not entitled to the name "blended maple syrup," since it did not contain any maple sirup; also because, under the statute, the question of whether an element of a mixture is a "like" substance with a flavoring material can not be considered in determining whether the mixture is a blend, and, further, because even if there were any degree of likeness between the cane-sugar sirup and the extract of maple wood, and this likeness could be considered, it is not properly described or characterized by the words "maple syrup."

The question has been raised in several jurisdictions whether it is necessary, before filing of a libel in rem for condemnation and forfeiture under section 10 of the act, that there should be a preliminary examination of an alleged adulterated or misbranded product by the Department of Agriculture and a hearing before the Secretary of Agriculture, provided for by section 4 of the act. In United States *v.* Fifty Barrels of Whisky (165 Fed., 966; Notice of Judgment No. 68) the court held that the provision of section 4 of the act relates only to proceedings under section 2, and that neither a preliminary examination of the product nor a hearing before the Secretary of Agriculture is required before the filing of a libel for condemnation and forfeiture. To the same effect are the decisions in United States *v.* Sixty-five Casks of Liquid Extract (170 Fed. 449; Notice of Judgment No. 284); United States *v.* One Hundred Cases of Tepee Apples et al., supra; United States *v.* Three Hundred Cases of Mapleine, supra; United States *v.* Thirty-six Cases of Metabolized Cod Liver Oil (Notice of Judgment No. 303).

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In United States *v.* Sixty-five Casks of Liquid Extract, supra, the claimants contended that the quantity or proportion of the drugs specified in section 8 of the act need not be declared in the case of drugs which are not labeled or branded. The court ruled adversely to this contention, deciding, in effect, that the act not only requires that drugs shipped in interstate commerce and labeled shall not be misbranded, but requires that they shall bear labels conforming to its provisions.

Decisions were rendered by the circuit courts of appeals in the following cases:

GUIDO BRINA v. UNITED STATES (NOTICE OF JUDGMENT No. 473; 179 FED., 373).

Brina was tried, convicted, and fined on the charge of shipping in interstate commerce a quantity of oil labeled "Olio per insalata sopraffino vival brand cotton salad oil extra qualita," which was misbranded because the statements on the label tended to deceive and mislead purchasers into believing that the oil was a superfine oil manufactured in Italy, when, in fact, the oil was not olive oil and was not manufactured in Italy. The defendant assigned as error the charge of the trial judge that "as a notorious fact salad oil prima facie means olive oil." The court held that the charge was proper, and affirmed the judgment of the trial court.

FRENCH SILVER DRAGEE COMPANY v. UNITED STATES (NOTICE OF JUDGMENT, No. 543; 179 FED., 824).

This case grew out of the interstate shipment of so-called silver dragees, a confection which was found by the court below to be adulterated by reason of the presence therein of a mineral matter, to wit, metallic silver. No evidence was offered tending to show that metallic silver is poisonous, or deleterious or detrimental to health, and the decision of the trial court was based upon the interpretation of the statute that all the Government need establish was that the confectionery contained a mineral substance. The judgment was reversed, and the court ruled that confectionery is adulterated within section 7 of the act if it contains any mineral substance used for the purposes of deception, or if it contain any poisonous mineral substance, or poisonous color or flavor, or if it contain any ingredient whatsoever which is deleterious or detrimental to health; in other words, to prove adulteration of confectionery containing a metallic substance it is held that the burden is on the Government to prove that the use of the substance operates to deceive purchasers or that the substance is injurious to health.

UNITED STATES v. KNOWLTON DANDERINE CO., CLAIMANTS (NOTICE OF JUDGMENT, No. 284); U. S. v. SIXTY-FIVE CASKS OF LIQUID EXTRACTS (170 FED., 449); SAME (175 FED., 1022).

Seizure was effected of a quantity of "Danderine," a drug product, on the charge of misbranding for the reason that the casks containing it failed to bear a statement of the quantity or proportion of alcohol therein. The claimants set up several distinct matters of defense, all of which were determined in favor of the United States, with the exception of the allegation that the consignment was not subject to seizure because it had not been transported from one State to another for sale. It was admitted in the agreed statement of facts on which the case was tried that the product was shipped for the distinct purpose of being bottled and labeled, and that when ready for sale the salable package bore a statement showing the content of alcohol. Furthermore, the record disclosed that the claimant shipped the said casks as its own product, made by its own agent in Michigan, to its own warehouse in West Virginia. The judgment of the district court in favor of the claimant was affirmed on the ground that there was no evidence of any attempt to evade the law either directly or indirectly. The Attorney-General held that this decision was not reviewable by the Supreme Court by certiorari or otherwise.

The jurisdictional question involved is presented, however, in United States *v.* Fifty Cases of Preserved Whole Egg, infra, now before the Supreme Court, in which the decision of the trial court was directly opposite to the decision in this case.

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Two cases were pending on appeal before the Supreme Court at the close of the year, as follows:

UNITED STATES v. JOHNSON (177 FED., 313; NOTICE OF JUDGMENT NO. 266).

Johnson shipped in interstate commerce a so-called "mild combination treatment for cancer," consisting of several packages, containing thereon certain statements or representations that the product would effect a cure of cancer. Misbranding was alleged in the indictment on the ground that these statements were false and misleading statements regarding the article, because it was useless and ineffective for the pretended purpose. Defendant's motion to quash was sustained, the court holding that inquiry under the food and drugs act to determine whether a drug is misbranded can not be extended to the question whether the product is effective or worthless to accomplish the purpose represented on its label. The case is pending on appeal taken under the provisions of the criminal appeals act of March 2, 1907.

HIPOLITE EGG COMPANY v. UNITED STATES (U. S. v. 50 CANS OF PRESERVED EGG, NOTICE OF JUDGMENT NO. 508.)

Fifty cans of preserved whole egg were seized in the possession of Thomas & Clarke, Peoria, Ill., and condemnation and forfeiture of the product was sought for the reason that it contained an added deleterious ingredient, to wit, boric acid, which might render it injurious to health. Thomas & Clarke appeared specially, claiming to be the owners of the product, and denied and relinquished all its right and title therein to the Hipolite Egg Company. In its answer the Hipolite Egg Company denied that the product contained boric acid, that boric acid was a deleterious ingredient and rendered the eggs deleterious to health, and that the eggs were transported and offered for sale in violation of the law. The issues thus raised were determined against the claimant and a decree was entered in favor of the United States. The court made a special finding of facts, stating among other facts, that the eggs were purchased by Thomas & Clarke and stored in a warehouse in their name at St. Louis, and that subsequently Thomas & Clarke sent a written order on the warehouse to the Hipolite Egg Company for the eggs to be delivered to the Hipolite Egg Company for shipment to Thomas & Clarke, and the eggs were thereupon procured by the Hipolite Egg Company and delivered to a common carrier for shipment to Thomas & Clarke, at Peoria. The storage charges and freight were paid by Thomas & Clarke. The Hipolite Egg Company appealed from the decree to the Supreme Court, where the case is now pending on both appeal and writ of error. Claimant asserts that the trial court was without jurisdiction in the premises, because the eggs in question were not shipped in interstate commerce for sale, and because the eggs had been delivered to Thomas & Clarke before seizure was effected and were not intended to be sold by them. The question whether the court had jurisdiction to assess costs against the Hipolite Egg Company is also presented in the appeal. (For judgment of the trial court, see Notice of Judgment No. 508.)

Two cases were pending at the close of the year before the circuit court of appeals for the fifth circuit on appeals taken by the claimants from judgments rendered in favor of the United States, as follows:

R. G. CHARLES v. UNITED STATES (UNITED STATES v. 2,000 CASES OF CANNED TOMATOES, NOTICE OF JUDGMENT NO. 555).

Libel was filed against 2,000 cases of canned tomatoes labeled "No. 3 perfection brand tomatoes," alleged to be adulterated and misbranded for the reason that the cans contained filthy, decomposed, or putrid substances, and a poisonous ingredient, salts of tin, which might render the product injurious to health. A decree was rendered condemning a portion of the canned tomatoes as adulterated as alleged, and directing the marshal to separate the good from bad, destroy the bad cans, and deliver the good cans to the claimant. The costs of the proceedings were taxed against the claimant. To this decree the claimant excepted and perfected his appeal within the prescribed period.

WARNER-JENKINSON COMPANY v. UNITED STATES.

Seizure was effected, under section 10 of the act, of one barrel of an article of food bearing no label or brand, but which was represented, sold, and invoiced as "All bean vanilla." Adulteration and misbranding was alleged, for the reason that a

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mixture of commercial vanillin and coumarin, artificially colored, had been substituted for vanilla extract, and because the article was an imitation of and offered for sale under the name of all-bean vanilla. The claimant excepted to the sufficiency of the libel, and the exceptions were overruled and a decree of condemnation and forfeiture entered against the product. The claimant, in due course, filed its assignment of errors and sued out a writ of error, on which the case was pending at the close of the year.

There was also pending before the circuit court of appeals for the eighth circuit the case of the Nave-McCord Mercantile Company *v.* United States. The plaintiff in error shipped in interstate commerce an article of food labeled "A pure flavor Eden brand flavor of lemon and citral. Natural color." Analysis of samples procured from the shipment showed that the product contained no appreciable quantity of oil of lemon and very little citral, and in due course a criminal information was filed against the company charging the interstate shipment and alleging that the article was adulterated and misbranded because it was represented by the label to be a pure flavor or extract derived from the lemon fruit containing the oil of lemon and citral derived from said fruit, when in fact it contained no lemon oil, but did contain an added substance not derived from the fruit, to wit, citral. A demurrer was interposed, attacking the sufficiency of the information and alleging that it was improperly filed, not being founded on the affidavits of witnesses who could speak from personal knowledge of the facts. This demurrer was overruled and the defendant company entered a formal plea of not guilty. The case was then tried to the court, and the judgment declared the defendant guilty as charged, and adjudged that it pay a fine of $200 and costs. The defendant thereupon sued out its writ of error and the case is pending to have reviewed errors claimed to appear in the record and for determination whether the facts found by the trial court warranted the judgment of conviction and the fine assessed.

NOTICES OF JUDGMENT.

In January you directed that the notices of judgment required by section 4 of the act, which had theretofore been prepared by the Bureau of Chemistry, subject to the Solicitor's approval, should be prepared in the Office of the Solicitor. Three hundred and twenty-nine notices of judgments of the courts in food and drug cases were published during the six months ending June 30, 1910, and 100 more were completed and in the course of publication. Notices were prepared in every case of the termination of which the Department had been officially advised by the United States attorneys up to the close of the year, including cases decided adversely as well as favorably to the Government. Care has been exercised to insure that the notices set forth accurately the facts in each case as they appear on the records of the court, and it is believed that they are important factors in securing observance of the law, since they operate not only to deter future violations by the parties responsible for the adulteration or misbranding of the particular food or drug which is the subject of the notice, but serve to acquaint manufacturers and producers generally with the interpretation placed by the courts on the provisions of the act defining adulteration and misbranding.

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
632	Terry-Taylor Drug Co.	Virginia, eastern district.	Shipment of adulterated and misbranded vanilla extract from Virginia to North Carolina.	Information filed; pending.
635	Star Spring Water Co.	New York, northern district.	Shipment of adulterated water from New York to Massachusetts.	Defendant convicted; sentence suspended.
638	Lambert & Louman.	Michigan, eastern district.	Shipment of misbranded wine of coca from Michigan to New York.	Defendant pleaded nolo contendere and fined $10. (Notice of Judgment No. 204.)
640	A. Waller & Co...	Kentucky, western district.	Shipment of misbranded feed from Kentucky to New York.	Defendant pleaded guilty; fined $25 and costs. (Notice of Judgment No. 400.)
643	John A. Falck Co..	New Jersey.....	Shipment of misbranded headache cure from New Jersey to the District of Columbia.	Defendant pleaded non vult; sentence suspended. (Notice of Judgment No. 418.)
644	Knoxville Drug Co.	Tennessee, eastern district.	Shipment of adulterated and misbranded lemon extract from Tennessee to North Carolina.	Defendant fined $10 and costs, $24.85. (Notice of Judgment No. 585.)
645	Murray & Nickell Manufacturing Co.	Illinois, northern district.	Shipment of adulterated and misbranded powdered colocynth from Illinois to Missouri.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 292.)
646	W. H. Harrison & Co.	Ohio, southern district.	Shipment of adulterated and misbranded buckwheat flour from Ohio to Indiana.	Defendant pleaded nolo contendere and fined $5 and costs, $18.60. (Notice of Judgment No. 263.)
647	Huber & Fuhrman.	Wisconsin, eastern district.	Shipment of adulterated and misbranded powdered colocynth from Wisconsin to Texas.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 192.)
651	The Sethness Co..	Illinois, northern district.	Shipment of misbranded Kos Kola from Illinois to Michigan.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 296.)
652	S. W. Gould & Bros.	Massachusetts.....	Shipment of adulterated and misbranded powdered colocynth from Massachusetts to Texas.	Information filed; pending.
654	Jones Bros. & Co.	Kentucky, western district.	Shipment of adulterated and misbranded vinegar from Kentucky to Mississippi.	Do.
655	Birmingham Celery Cola Co.	Alabama, northern district.	Shipment of misbranded Celery Cola from Alabama to Louisiana.	Defendants, J. F. Hawkins, J. W. Altman, and J. G. Bradley, composing the company, pleaded not guilty; J. F. Hawkins and J. W. Altman convicted and fined $25 each; J. G. Bradley found not guilty. (Notice of Judgment No. 326.)
656	Lange Bros.....	New York, southern district.	Shipment of misbranded olive oil from New York to Massachusetts.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 348.)
657	R. M. Hughes & Co.	Kentucky, western district.	Shipment of adulterated and misbranded vinegar from Kentucky to North Carolina.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 278.)
659	Gilpin, Langdon & Co.	Maryland.....	Shipment of adulterated and misbranded powdered colocynth from Maryland to Ohio.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 183.)
660	Huber & Fuhrman Drug Mills.	Wisconsin, eastern district.	Shipment of adulterated and misbranded powdered colocynth from Wisconsin to Michigan.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 192.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
661	McIlvaine Bros...	Pennsylvania, eastern district.	Shipment of adulterated and misbranded powdered colocynth from Pennsylvania to Ohio.	Defendant pleaded nolo contendere and fined $10. (Notice of Judgment No. 390.)
663	Baltimore Manufacturing Co.	Maryland.....	Shipment of adulterated and misbranded vinegar from Maryland to Virginia.	Defendant pleaded guilty; fined $50 and costs. (Notice of Judgment No. 394.)
664	Tuckahoe Mineral Springs Co.	Pennsylvania, middle district.	Shipment of misbranded water from Pennsylvania to District of Columbia.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 424.)
665	Michigan Produce Co.	Michigan, eastern district.	Shipment of adulterated and misbranded cheese from Michigan to Illinois.	Defendant pleaded nolo contendere and fined $10. (Notice of Judgment No. 344.)
667	Gordon Vinegar Co.	.....do.....	Shipment of adulterated and misbranded vinegar from Michigan to Ohio.	Defendant entered plea of nolo contendere and sentenced to pay costs. $6.25. (Notice of Judgment No. 189.)
668	Tilman & Bendel..	California, northern district.	Shipment of adulterated and misbranded lemon extract from California to Nevada.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 416.)
669	United Cereal Co..	Iowa, southern district.	Shipment of misbranded rolled oats from Iowa to Illinois.	Information filed; no service obtained on defendant; pending.
670	R. M. Hughes & Co.	Kentucky, western district.	Shipment of adulterated and misbranded cider vinegar from Kentucky to Alabama.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 278.)
671	Price & Lucas Cider and Vinegar Co.	Pennsylvania, western district.	Shipment of adulterated and misbranded cider vinegar from Pennsylvania to West Virginia.	Defendant convicted and fined $50 and costs, $13.30. (Notice of Judgment No. 240.)
672	Philadelphia Importing Produce Co.	Pennsylvania, eastern district.	Shipment of adulterated and misbranded olive oil from Pennsylvania to Massachusetts.	Information filed; no service obtained on defendant; pending.
677	W. H. Shaw & Co.	Maryland.....	Shipment of misbranded "Bromo Febrin" from Maryland to Michigan.	Defendant pleaded guilty and fined $20. (Notice of Judgment No. 182.)
683	Gordon Syrup Co..	California, northern district.	Shipment of adulterated and misbranded maple sirup from California to Arizona Territory.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 412.)
684	Wells Medicine Co.	Indiana.....	Shipment of misbranded headache cure from Indiana to Michigan.	Defendant pleaded guilty; fined $10 and costs. (Notice of Judgment No. 630.)
685	F. Chevalier Co....	California, northern district.	Shipment of adulterated and misbranded apricot brandy from California to Nevada.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 413.)
686	Henry Boberink..	Indiana.....	Shipment of adulterated milk from Indiana to Ohio.	Defendant pleaded guilty; fined $10 and costs. (Notice of Judgment No. 219.)
694	C. F. Blanke Tea and Coffee Co.	Missouri, eastern district.	Shipment of misbranded coffee from Missouri to Arkansas.	Defendant pleaded guilty and fined $5. (Notice of Judgment No. 275.)
695	.....do.....	.....do.....	Shipment of misbranded coffee from Missouri to Oklahoma.	Do.
698	The Kumfort Co..	Georgia, northern district.	Shipment of misbranded Coke Extract from Georgia to Tennessee.	Defendant pleaded guilty and fined $15 and costs. (Notice of Judgment No. 309.)
699	Benjamin H. Lambert.	Michigan, eastern district.	Shipment of misbranded Burgundy Wine of Cocoa from Michigan to Illinois.	Defendant pleaded nolo contendere and fined $10. (Notice of Judgment No. 204.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
700	Koca Nola Co.....	Georgia, northern district.	Shipment of adulterated and misbranded Koca Nola sirup from Georgia to Louisiana.	Defendant convicted and fined $50. (Notice of Judgment No. 202.)
701	The Sethness Co..	Illinois, northern district.	Shipment of adulterated and misbranded Koa Kola from Illinois to the District of Columbia.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 296.)
702	Henry A. Bobrink.	Indiana.....	Shipment of adulterated milk from Indiana to Ohio.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 607.)
706	Brown Manufacturing Co.	Tennessee, eastern district.	Shipment of misbranded headache cure from Tennessee to Michigan.	Defendant pleaded guilty; fined $10 and costs. (Notice of Judgment No. 465.)
707	The Mount Pickle Co.	Utah.....	Shipment of adulterated and misbranded vinegar from Utah to Idaho.	Defendant pleaded guilty and fined $35 and costs, $14. (Notice of Judgment No. 678.)
708	Vanderhoof & Co..	Indiana.....	Shipment of misbranded headache remedy from Indiana to Michigan.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 631.)
709	Charles L. Hirsh & Co.	New York, southern district.	Shipment of adulterated and misbranded vinegar from New York to Pennsylvania.	Defendant pleaded guilty and fined $5. (Notice of Judgment No. 197.)
710	W. H. Perry.....	Kentucky, eastern district.	Shipment of adulterated milk from Kentucky to Ohio.	Jury trial; verdict not guilty. (Notice of Judgment No. 588.)
714	National Manufacturing Co.	Missouri, western district.	Shipment of misbranded molasses from Missouri to Colorado.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 541.)
715	O. L. Gregory Vinegar Co.	Kentucky, western district.....	Shipment of adulterated and misbranded vinegar from Kentucky to Tennessee.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 286.)
719	Nestly Bros.....	Kentucky, eastern district.	Shipment of adulterated milk from Kentucky to Ohio.	Defendant pleaded guilty and fined $15. (Notice of Judgment No. 587.)
720	S. W. Gould & Bros.	Massachusetts.....	Shipment of adulterated and misbranded powdered colocynth from Massachusetts to Michigan.	Information filed; pending.
721	J. L. Lombardo Co.	New York, western district.	Shipment of misbranded hair tonic from New York to Michigan.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 319.)
723	Huber & Fuhrman Drug Mills.	Wisconsin, eastern district.	Shipment of adulterated and misbranded colocynth from Wisconsin to Ohio.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 192.)
724	Charles W. Horn..	Pennsylvania, eastern district.	Shipment of misbranded headache tablets from Pennsylvania to Michigan.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 392.)
725	Price & Lucas Cider and Vinegar Co.	Kentucky, western district.	Shipment of adulterated and misbranded vinegar from Kentucky to Indiana.	Information filed; pending.
727	J. Lindsay Wells Co.	Tennessee, western district.	Shipment of adulterated and misbranded cotton-seed meal from Tennessee to Indiana.	Information filed; motion to quash entered pending.
729	Cereal Products Co.	Minnesota.....	Shipment of misbranded stock food from Minnesota to Illinois.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 298.)
730	Houston Drug Co.	Texas, southern district.	Shipment of misbranded headache cure from Texas to Michigan.	Defendant pleaded guilty and fined $50 and costs. (Notice of Judgment No. 208.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
731	American Pickling Co.	Rhode Island.....	Shipment of adulterated and misbranded strawberry jam from Rhode Island to Massachusetts.	Defendant indicted pending.
735	John Fisher.....	Kentucky, eastern district.	Shipment of adulterated milk from Kentucky to Ohio.	Defendant pleaded guilty and fined $15. (Notice of Judgment No. 586.)
736	Murray & Nickell Manufacturing Co.	Illinois, northern district.	Shipment of adulterated and misbranded powdered colocynth from Illinois to Michigan.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 292.)
737	Hills Bros.....	California, northern district.	Shipment of misbranded coffee from California to Colorado.	Grand jury failed to return indictment.
738	Enimert Proprietary Co.	Illinois, northern district.	Shipment of misbranded teething sirup from Illinois to Michigan.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 610.)
739	Make-Man Tablet Co.	.....do.....	Shipment of misbranded "Make-Man" tablets from Illinois to Indiana.	Defendant pleaded nolo contendere and fined $10. (Notice of Judgment No. 294.)
740	Fig Prune Cereal Co.	California, northern district.	Shipment of misbranded "fig prune" from California to New York.	Defendant pleaded guilty and fined $100.
741	Hall-Whitney Manufacturing Co.	New York, northern district.	Shipment of adulterated and misbranded vanilla extract from New York to Ohio.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 663.)
742	Quinine Whisky Co.	Kentucky, western district.	Shipment of adulterated and misbranded quinine whisky from Kentucky to Illinois.	Information filed; pending.
743	D. W. Hutchinson.	New York, southern district.	Shipment of misbranded lemon oil from New York to New Jersey.	Defendant pleaded guilty and fined $2. (Notice of Judgment No. 196.)
744	Bennett Sloan & Co.	.....do.....	Shipment of adulterated and misbranded pepper from New York to North Carolina.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 297.)
748	F. H. Finley & Son.	District of Columbia.	Offering for sale misbranded lithia water in the District of Columbia.	Information filed; pending.
750	Italian Star Produce Co.	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to Massachusetts.	Do.
751	Hall-Whitney Manufacturing Co.	New York, northern district.	Shipment of adulterated and misbranded extract of lemon from New York to Indiana.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 644.)
753	Puhl Manufacturing Co.	Illinois, northern district.	Shipment of adulterated and misbranded vanilla extract from Illinois to Wisconsin.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 330.)
756	J. Simon & Sons..	Missouri, eastern district.	Shipment of misbranded "Sporty Days Invigorator" from Missouri to Illinois.	Defendant pleaded guilty and fined $50 and costs. (Notice of Judgment No. 426.)
757	Alfred T. H. Hodnett.	Pennsylvania, middle district.	Shipment of adulterated soothing sirup from Pennsylvania to District of Columbia.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 401.)
758	Potter Drug & Chemical Corporation.	Massachusetts.....	Shipment of misbranded Cuticura ointment from Massachusetts to the District of Columbia.	Information filed; motion to quash entered; pending.
759	Louisiana Rice Milling Co.	Oregon.....	Shipment of misbranded rice from Oregon to Washington.	Defendant pleaded guilty and fined $25 and costs. $11.22. (Notice of Judgment No. 190.)
761	Acme Mills Company.	.....do.....	Shipment of misbranded gluten farina from Oregon to California.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 250.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
762	Potter Drug and Chemical Corporation.	Massachusetts.....	Shipment of misbranded Cuticura ointment from Massachusetts to the District of Columbia.	Information filed; motion to quash filed; pending.
765	Dr. Julian P. Thomas.	New York, southern district.	Shipment of misbranded bread from New York to Texas.	Defendant convicted; motion in arrest of judgment pending.
767	Potter Drug and Chemical Corporation.	Massachusetts.....	Shipment of misbranded Cuticura soap from Massachusetts to the District of Columbia.	Information filed; motion to quash filed; pending.
768	William Numsen & Sons.	Maryland.....	Shipment of misbranded preserves from Maryland to Texas.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 212.)
770	Berry - Maybrun Co.	Louisiana, eastern district.	Shipment of misbranded molasses from Louisiana to California.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 234.)
772	Bradfield Regulator Co.	Georgia, northern district.	Shipment of misbranded drug, "Mother's Friend" from Georgia to Pennsylvania.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 636.)
776	J. L. Kraft & Bros.	Illinois, northern district.	Shipment of adulterated and misbranded cheese from Illinois to New York.	Defendant pleaded guilty and fined $10 and costs, $15.60. (Notice of Judgment No. 291.)
778	C. F. Blanke Tea and Coffee Co.	Missouri, eastern district.	Shipment of misbranded coffee from Missouri to Pennsylvania.	Defendant pleaded guilty and fined $5. (Notice of Judgment No. 275.)
779	The Ranney Drug Co.	New York, southern district.	Shipment of misbranded witch hazel from New York to New Jersey.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 357.)
780	Lawrence & Hamilton Feed Co.	Louisiana, eastern district.	Shipment of adulterated and misbranded feed from Louisiana to Georgia.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No.477.)
781	Phoenix Cheese Co.	New York, southern district.	Shipment of misbranded cheese from New York to District of Columbia.	Information filed; court sustained demurrer. (Notice of Judgment No. 576.)
783	Dr. Johnson Remedy Co.	Missouri, western district.	Shipment of misbranded cancer cure from Missouri to the District of Columbia.	Indictment returned; plea of not guilty; motion to quash sustained. Pending in Supreme Court on appeal. (Notice of Judgment No. 266.)
784	John Morgan.....	New York, southern district.	Shipment of misbranded water from New York to New Jersey.	Defendant convicted; motion in arrest of judgment allowed; appeal pending.
789	Globe Elevator Co.	New York, western district.	Shipment of adulterated and misbranded flour middlings from New York to Pennsylvania.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 314.)
790	Earll Coffee Co....	Missouri, western district.	Shipment of adulterated and misbranded lemon extract from Missouri to Kansas.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No.480.)
791	American Milling Co.	Illinois, southern district.	Shipment of adulterated and misbranded dairy feed from Illinois to Iowa.	Defendant convicted; fined $20 and costs. (Notice of Judgment No. 432.)
804	Henry Boberink..	Indiana.....	Shipment of adulterated milk from Indiana to Ohio.	Defendant pleaded guilty; consolidated with 686, supra. (Notice of Judgment No. 219.)
805	Fowle Maple Syrup Co. of Minnesota.	Minnesota.....	Shipment of misbranded sirup from Minnesota to Nebraska.	Grand jury failed to return indictment.

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
808	Alfalfa Milling Co.	Oklahoma, western district.	Shipment of misbranded alfalfa meal from Oklahoma to Kentucky.	Information filed; pending.
813	Webb Manufacturing Co.	Tennessee, middle district.	Shipment of adulterated and misbranded orange extract from Tennessee to Alabama.	Defendant pleaded guilty and fined $25 and costs, $9.05. (Notice of Judgment No. 408.)
814	Bruen, Ritchey & Co.	New York, southern district.	Shipment of adulterated and misbranded gum asafetida from New York to New Jersey.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 583.)
815	Webb Manufacturing Co.	Tennessee, middle district.	Shipment of adulterated and misbranded banana extract from Tennessee to Alabama.	Defendant pleaded guilty and fined $75 and costs, $9. (Notice of Judgment No. 405.)
816	Dr. L. T. Leach...	Indiana.....	Shipment of misbranded cancer cure from Indiana to District of Columbia.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No.606.)
821	Canby, Ach & Canby Co.	Ohio, southern district.	Shipment of adulterated and misbranded coffee from Ohio to Illinois.	Defendant pleaded guilty and fined $10 and costs, $21.70. (Notice of Judgment No. 215.)
822	Interstate Chemical Co.	Maryland.....	Shipment of adulterated and misbranded vanilla extract from Maryland to Texas.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 139.)
827	J. L. Kraft & Bros.	Illinois, northern district.	Shipment of adulterated and misbranded cheese from Illinois to Missouri.	Defendant pleaded guilty and fined $10 and costs, $15.60. (Notice of Judgment No. 291.)
828	Ideal Cocoa and Chocolate Co.	Pennsylvania, eastern district.	Shipment of adulterated and misbranded cocoa from Pennsylvania to Maryland.	Information filed; pending.
830	Perlitch's Pharmacy.	New York, eastern district.	Shipment of misbranded headache powders from New York to Michigan.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 260.)
833	Zeeland Cheese and Butter Co.	Michigan, western district.	Shipment of misbranded cheese from Michigan to Wisconsin.	Grand jury returned no true bill.
835	Vermont Farmers Co.	Massachusetts.....	Shipment of adulterated and misbranded butter from Massachusetts to District of Columbia.	Information filed; pending.
837	Williams Bros. & Co.	Michigan, eastern district.	Shipment of adulterated and misbranded apple jelly from Michigan to Alabama.	Defendant pleaded nolo contendere and fined $5. (Notice of Judgment No. 238.)
838	Frank Tea and Spice Co.	Ohio, southern district.	Shipment of adulterated and misbranded pepper from Ohio to Nevada.	Information filed; demurrer argued; pending.
839	McLemore Grain Co.	Tennessee, middle district.	Shipment of adulterated and misbranded oats from Tennessee to Alabama.	Defendant pleaded guilty and fined $100 and costs, $9.90. (Notice of Judgment No. 406.)
840	Earll Coffee Co....	Missouri, western district.	Shipment of adulterated and misbranded lemon extract from Missouri to Kansas.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No.480.)
842	Charles A. Krause Milling Co.	Wisconsin, eastern district.	Shipment of adulterated and misbranded dairy feed from Wisconsin to North Carolina.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 172.)
843	Capital Grain and Mill Co.	Tennessee, middle district.	Shipment of misbranded chicken feed from Tennessee to North Carolina.	Defendant pleaded guilty and fined $75 and costs, $9.80. (Notice of Judgment No. 404.)
844	Analgine Tablet Co.	New Jersey.....	Shipment of misbranded "Analgine tablets" from New Jersey to Michigan.	Defendant pleaded guilty and fined $15. (Notice of Judgment No. 276.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
845	F. Chevalier Co...	California, northern district.	Shipment of adulterated and misbranded peach brandy from California to Nevada.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 414.)
846	Price & Lucas Cider and Vinegar Co.	Kentucky, western district.	Shipment of adulterated and misbranded vinegar from Kentucky to Tennessee.	Information filed; pending.
847	H. Erdmann's Sons.	Pennsylvania, eastern district.	Shipment of adulterated and misbranded vinegar from Pennsylvania to Delaware.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 570.)
848	J. D. Williams & Bros. Co.	Pennsylvania, middle district.	Shipment of misbranded cough drops from Pennsylvania to District of Columbia.	Information filed; pending.
852	Steinhorst-Morrin Pickle Co.	Missouri, western district.	Shipment of adulterated and misbranded vinegar from Missouri to Texas.	Defendant pleaded nolo contendere and fined $25 and costs, $18.10. (Notice of Judgment No. 645.)
853	Kinne Medicine Co.	Michigan, eastern district.	Shipment of misbranded headache cure from Michigan to Louisiana.	Defendant pleaded nolo contendere and fined $10. (Notice of Judgment No. 346.)
854	Steinhorst-Morrin Pickle Co.	Missouri, western district.	Shipment of adulterated and misbranded vinegar from Missouri to Arizona.	Defendant pleaded nolo contendere and fined $25 and costs, $5.85. (Notice of Judgment No. 645.)
855	Lekas & Drivas...	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to Massachusetts.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 360.)
856	Harbauer-Marleau Co.	Ohio, northern district.	Shipment of adulterated and misbranded vinegar from Ohio to Missouri.	Defendant indicted; pending.
857	Shoemaker & Busch.	Pennsylvania, eastern district.	Shipment of misbranded oil of lemon from Pennsylvania to District of Columbia.	Defendant pleaded nolo vult contendere and fined $25. (Notice of Judgment No. 393.)
858	Board, Armstrong & Co.	Virginia, eastern district.	Shipment of adulterated and misbranded cider vinegar from Kentucky to Alabama.	Information filed; pending.
860	Barrett & Barrett.	Illinois, northern district.	Shipment of adulterated and misbranded apple vinegar from Illinois to Wisconsin.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 289.)
862	Capital Grain and Mill Co.	Tennessee, middle district.	Shipment of misbranded alfa-corn feed from Tennessee to North Carolina.	Defendant pleaded guilty and fined $75 and costs, $9.80. (Notice of Judgment No. 404.)
864	Delaware Drug Co.	New York, northern district.	Shipment of misbranded headache powder from New York to Michigan.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 643.)
868	Harbauer-Marleau Co.	Ohio, northern district.	Shipment of adulterated and misbranded vinegar from Ohio to Illinois.	Defendant indicted; pending.
870	.....do.....	.....do.....	Shipment of adulterated and misbranded vinegar from Ohio to Pennsylvania.	Do.
871	Emelia Bisi.....	Pennsylvania, western district.	Shipment of adulterated and misbranded egg noodles from Pennsylvania to West Virginia.	Defendant pleaded nolo contendere and fined $50. (Notice of Judgment No. 686.)
872	Keller-Lorenz Co.	Washington, eastern district.	Shipment of adulterated and misbranded vinegar from Washington to Idaho.	Defendant pleaded guilty and fined $25 and costs, $27.10. (Notice of Judgment No. 243.)
873	Lima Fruit Juice Co.	Ohio, northern district.	Shipment of adulterated and misbranded cherry sirup from Ohio to Missouri.	Defendant pleaded nolo contendere and fined $25 and costs. (Notice of Judgment No. 549.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
874	Mills Preserving Co.	Louisiana, eastern district.	Shipment of adulterated and misbranded vinegar from Louisiana to Florida.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 199.)
876	Price & Lucas Cider and Vinegar Co.	Kentucky, western district.	Shipment of adulterated and misbranded vinegar from Kentucky to Indiana.	Information filed; pending.
877	Barrett & Barrett.	Illinois, northern district.	Shipment of adulterated and misbranded cider vinegar from Illinois to Indiana.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 289.)
880	Board, Armstrong & Co.	Virginia, eastern district.	Shipment of adulterated and misbranded vinegar from Virginia to Minnesota.	Information filed; pending.
883	Harbauer-Marleau Co.	Ohio, northern district.	Shipment of adulterated and misbranded vinegar from Ohio to Indiana.	Defendant indicted; pending.
884	The Canby, Ach & Canby Co.	Ohio, southern district.	Shipment of misbranded coffee from Ohio to Indiana.	Defendant pleaded guilty and fined $10 and costs, $13.25. (Notice of Judgment No. 215.)
885	Oakland Vinegar and Pickle Co.	Michigan, eastern district.	Shipment of adulterated and misbranded cider vinegar from Michigan to North Dakota.	Defendant pleaded nolo contendere and fined $15. (Notice of Judgment No. 232.)
886	Rigney & Co.....	New York, eastern district.	Shipment of adulterated and misbranded maple sirup from New York to Missouri.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 384.)
887	Arkadelphia Milling Co.	Arkansas, eastern district.	Shipment of adulterated and misbranded bran from Arkansas to Louisiana.	Defendant pleaded guilty and fined $200 and costs. (Notice of Judgment No. 231.)
889	Spielmann Bros. Co.	Illinois, northern district.	Shipment of adulterated and misbranded cider vinegar from Illinois to Minnesota.	Defendant pleaded guilty and fined $12.50. (Notice of Judgment No. 399.)
890	American Beverage Co.	Missouri, eastern district.	Shipment of adulterated coca cream from Missouri to Kentucky.	Information filed; pending.
891	Price & Lucas Cider and Vinegar Co.	Pennsylvania, western district.	Shipment of adulterated and misbranded cider vinegar from Pennsylvania to West Virginia.	Defendant convicted and fined $50 and costs, $12.90. (Notice of Judgment No. 240.)
892	American Beverage Co.	Missouri, eastern district.	Shipment of misbranded ginger ale from Missouri to Kentucky.	Information filed; pending.
896	Mystic Milling Co.	Iowa, northern district.	Shipment of adulterated and misbranded ground corn from Iowa to Illinois.	Information filed; plea of not guilty entered; pending.
898 899 986	Cristani Importing Co.	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to Massachusetts and Connecticut.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 247.)
901	Louis Horpel & Co.	Maryland.....	Shipment of adulterated and misbranded custard from Maryland to Virginia.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 166.)
903	W. R. Plank Drug Co.	Wisconsin, eastern district.	Shipment of misbranded headache cure from Wisconsin to Michigan.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 191.)
904	Rosen & Flarsheim.	Missouri, eastern district.	Shipment of adulterated and misbranded corn from Missouri to Illinois.	Defendant pleaded not guilty to charge of adulteration and guilty to charge of misbranding; court directed a verdict of not guilty on first count and imposed a fine of $200 and costs on second count. (Notice of Judgment No. 471.)
905	D. R. Yarbrough & Co.	Tennessee, eastern district.	Shipment of adulterated and misbranded lemon extract from Tennessee to Alabama.	Information filed; pending.

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
906	Styron Beggs & Co.	Ohio, southern district.	Shipment of adulterated and misbranded lemon compound from Ohio to West Virginia.	Defendant pleaded nolo contendere and fined $5 and costs. (Notice of Judgment No. 237.)
909	Hallock-Denton Co.	New Jersey.....	Shipment of adulterated and misbranded lemon flavor from New Jersey to Pennsylvania.	Adulteration count nol prossed; defendant pleaded non vult to misbranding. Fined $50. (Notice of Judgment No. 277.)
910	Ingham Vinegar Co.	Oregon.....	Shipment of adulterated and misbranded cider vinegar from Oregon to Idaho.	Verdict in favor of defendant. (Notice of Judgment No. 398.)
911	Arkadelphia Milling Co.	Arkansas, eastern district.	Shipment of adulterated and misbranded oats from Arkansas to Louisiana.	Dismissed on plea of guilty entered by defendant in F. & D. No. 887, supra. (Notice of Judgment No. 231.)
912	Diamond Manufacturing Co.	Missouri, western district.	Shipment of misbranded tomato catsup from Missouri to Kansas.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 474.)
914	Warner-Jenkinson Co.	Missouri, eastern district.	Shipment of adulterated and misbranded strawberry flavor from Missouri to Tennessee.	Defendant pleaded guilty and fined $20 and costs. (Notice of Judgment No. 246.)
917	Liberty Mills.....	Tennessee, middle district.	Shipment of adulterated and misbranded bran from Tennessee to North Carolina.	Information filed; pending.
919	Long Syrup Refining Co.	California, northern district.	Shipment of adulterated and misbranded jelly from California to Washington.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 415.)
920	E. P. Mueller.....	Virginia, eastern district.	Shipment of adulterated and misbranded feed from Virginia to Maryland.	Information filed; pending.
921	O. P. White.....	Texas, eastern district.	Shipment of misbranded headache cure from Texas to Missouri.	Do.
922	The J. B. Edgar Grain Co.	Tennessee, western district.	Shipment of adulterated and misbranded cattle feed from Tennessee to Georgia.	Do.
925	Barrett & Barrett.	Illinois, northern district.	Shipment of adulterated and misbranded vinegar from Illinois to Oklahoma.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 318.)
926	J. F. Gearan.....	Massachusetts.....	Shipment of misbranded headache powders from Massachusetts to Michigan.	Defendant pleaded nolo contendere and fined $25. (Notice of Judgment No. 569.)
928	Oakland Vinegar and Pickle Co.	Michigan, eastern district.	Shipment of adulterated and misbranded vinegar from Michigan to Indiana.	Defendant pleaded nolo contendere and fined $10. (Notice of Judgment No. 232.)
929	Blanke-Baer Chemical Co.	Missouri, eastern district.	Shipment of adulterated and misbranded vanilla extract from Missouri to Wisconsin.	Defendant pleaded guilty and fined $20 and costs. (Notice of Judgment No. 242.)
932	Bridgeport Mills..	Tennessee, eastern district.	Shipment of misbranded mixed feed from Tennessee to North Carolina.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 464.)
933	M. C. Peters Mill Co.	Nebraska.....	Shipment of misbranded pasture meal from Nebraska to Illinois.	Information filed; pending.
935	Acme Milling Co..	Tennessee, eastern district.	Shipment of misbranded feed from Tennessee to North Carolina.	Do.
936	.....do.....	.....do.....	.....do.....	Do.
938	Arkadelphia Milling Co.	Arkansas, eastern district.	Shipment of adulterated and misbranded shorts from Arkansas to Louisiana.	Dismissed by court after defendant pleaded guilty in F. & D. No. 887, supra. (Notice of Judgment No. 231.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
939	Cyphers' Incubator Co.	Missouri, western district.	Shipment of misbranded "forcing food" from Missouri to Georgia.	Information filed; pending.
948	Evansville Bottling Co.	Indiana.....	Shipment of adulterated and misbranded "Cola" from Indiana to Missouri.	Indictment returned; pending.
952	Knadler & Lucas..	Kentucky, western district.	Shipment of adulterated and misbranded vinegar from Kentucky to Arkansas.	Information filed; pending.
953	Harbauer - Marleau Co.	Ohio, northern district.	Shipment of adulterated and misbranded vinegar from Ohio to Indiana.	Defendant indicted; pending.
956	.....do.....	.....do.....	Shipment of adulterated and misbranded vinegar from Ohio to Michigan.	Do.
957	.....do.....	.....do.....	Shipment of adulterated and misbranded vinegar from Ohio to West Virginia.	Do.
958	.....do.....	.....do.....	Shipment of adulterated and misbranded vinegar from Ohio to Illinois.	Do.
961	Pasquale de Vivo Co.	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to New Jersey.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 244.)
962	Leroux Cider Vinegar Co.	Ohio, northern district.	Shipment of adulterated and misbranded cider vinegar from Ohio to Illinois.	Defendant indicted; pending.
967	Ignatius Gross....	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to Connecticut.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 340.)
968	P. E. Sharpless Co.	Pennsylvania, eastern district.	Shipment of adulterated cheese from Pennsylvania to New Jersey.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 562.)
970	Billings, Clapp & Co.	Massachusetts.....	Shipment of misbranded "Kola" from Massachusetts to New Jersey.	Information filed; pending.
971	Jones Bros. & Co.	Kentucky, western district.	Shipment of adulterated and misbranded vinegar from Kentucky to West Virginia.	Held up pending other cases.
972	Aceton Medical Co.	Connecticut.....	Shipment of misbranded headache powders from Connecticut to Massachusetts.	Defendant pleaded guilty and fined $75. (Notice of Judgment No. 233.)
973	Mountain City Mill Co.	Tennessee, eastern district.	Shipment of misbranded feed product from Tennessee to North Carolina.	Information filed; pending.
975	C. W. Sherman...	Vermont.....	Shipment of adulterated and misbranded maple sirup from Vermont to Massachusetts.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 603.)
976	Make-Man Tablet Co.	Illinois, northern district.	Shipment of misbranded "Make-Man" tablets from Illinois to District of Columbia.	Defendant pleaded nolo contendere and fined $10. (Notice of Judgment No. 294.)
979	Zeeland Cheese and Butter Co.	Michigan, western district.	Shipment of adulterated and misbranded cheese from Michigan to New Jersey.	Leave to file information denied; pending.
980	Nicholas Spadaro.	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to New Jersey.	Information filed; pending.
981	D. Fahrney & Son.	Maryland.....	Shipment of misbranded vinegar from Maryland to Virginia.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 144.)
982	Hipolite Egg Co...	Missouri, eastern district.	Shipment of adulterated eggs from Missouri to Illinois.	Information filed; pending.
986	Cristani Importing Co.	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to Massachusetts.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 247.)
988	Parker Blake Co..	Louisiana, eastern district.	Shipment of misbranded headache cure from Louisiana to Missouri.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 258.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
992	Carpenter Cook Co	Michigan, western district.	Shipment of adulterated and misbranded lemon flavor from Michigan to Wisconsin.	Leave to file information denied; pending.
993	Alex. C. Harsh and James K. Polk.	Tennessee, middle district.	Shipment of adulterated oats from Tennessee to Georgia.	Defendant pleaded guilty and fined $75 and costs, $14.95. (Notice of Judgment No. 409.)
994	Long Syrup Refining Co.	California, northern district.	Shipment of adulterated and misbranded preserves from California to Montana.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 415.)
995	Stanley K. Pierson.	New York, western district.	Shipment of misbranded headache cure from New York to Michigan.	Information filed; pending.
997	F. X. Baumert & Co.	New York, northern district.	Shipment of misbranded cheese from New York to Michigan.	Leave to file information denied; pending.
999	The Arthur Chemical Co.	Connecticut.....	Shipment of adulterated and misbranded spirits camphor from Connecticut to New York.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 221.)
1000	F. X. Baumert & Co.	New York, northern district.	Shipment of misbranded cheese from New York to Pennsylvania.	Leave to file information denied; pending.
1003	Read Bros.....	Tennessee, eastern district.	Shipment of misbranded feed product from Tennessee to North Carolina.	Case dismissed as to T. R. Read; J. S. Read pleaded guilty and was fined $25. (Notice of Judgment No. 463.)
1004	Spielmann Bros. Co.	Illinois, northern district.	Shipment of adulterated and misbranded cider vinegar from Illinois to Iowa.	Defendant pleaded guilty and fined $12.50. (Notice of Judgment No. 399.)
1005	Dallemand & Co..	.....do.....	Shipment of adulterated and misbranded essence of wintergreen from Illinois to Michigan.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 293.)
1006	Wieland Bros. and The Novato French Cheese Co.	California, northern district.	Shipment of misbranded cheese from California to Washington.	Defendant indicted; demurrer interposed; pending.
1007	.....do.....	.....do.....	.....do.....	Do.
1009	Lowry Coffee Co...	Pennsylvania, eastern district.	Shipment of misbranded coffee from Pennsylvania to Virginia.	Defendant convicted and fined $10. (Notice of Judgment No. 611.)
1011	Joseph Volz.....	Indiana.....	Shipment of misbranded milk from Indiana to Ohio.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 629.)
1012	.....do.....	.....do.....	.....do.....	Consolidated with 1011.
1013	Edward J. Koechlin.	.....do.....	.....do.....	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 680.)
1014	Lewis Schutte.....	.....do.....	.....do.....	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 638.)
1015	Alfalfa Milling Co..	Oklahoma, western district.	Shipment of misbranded alfarine from Oklahoma to Georgia.	Information filed; demurrer interposed; pending.
1017	Napa and Sonoma Wine Co.	California, northern district.	Shipment of misbranded wine from California to Colorado.	Defendant indicted; demurrer interposed; pending.
1018	Leroux Cider and Vinegar Co.	Ohio, northern district.	Shipment of adulterated and misbranded cider vinegar from Ohio to Louisiana.	Defendant indicted; pending.
1020	West Point Mill Co.	South Carolina....	Shipment of misbranded rice meal from South Carolina to North Carolina.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 579.)
1021	Hen-e-ta Bone Co.	West Virginia; northern district.	Shipment of misbranded bone grits from West Virginia to Pennsylvania.	Court directed a verdict of not guilty. (Notice of Judgment No. 625.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1023	J. S. Campbell & Co.	Utah	Shipment of adulterated and misbranded lemon extract from Utah to Idaho.	Defendant pleaded guilty and fined $20. (Notice of Judgment No. 259.)
1025	Frederick W. Warner.	New York, western district.	Shipment of misbranded "Toxo-Absorbent" from New York to District of Columbia.	Defendant arraigned; plea of not guilty; pending.
1026	Paul Manufacturing Co.	Massachusetts	Shipment of adulterated and misbranded orange extract from Massachusetts to Rhode Island.	Information filed; pending.
1028	Drake Brothers Co.	Wisconsin, eastern district.	Shipment of misbranded olive oil from Wisconsin to Michigan.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 605.)
1030	Orator F. Woodward.	New York, western district.	Shipment of misbranded headache capsules from New York to Michigan.	Information filed; pending.
1031	Heekin Spice Co.	Ohio, southern district.	Shipment of adulterated and misbranded turpentine from Ohio to Indiana.	Defendant pleaded guilty and fined $5 and costs, $13.40. (Notice of Judgment No. 248.)
1032	Loreck & Lowrance.	South Carolina	Shipment of adulterated and misbranded turpentine from South Carolina to Virginia.	Information filed; pending.
1033	Frank Tea and Spice Co.	Ohio, southern district.	Shipment of adulterated and misbranded turpentine from Ohio to Arizona.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 337.)
1034	Gulf Manufacturing Co.	Louisiana, eastern district.	Shipment of adulterated and misbranded spirits of turpentine from Louisiana to Texas.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 539.)
1035	John H. Fitch Coffee Co.	Ohio, northern district.	Shipment of misbranded coffee from Ohio to Pennsylvania.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 547.)
1037	S. R. Chamlee	Missouri, eastern district.	Shipment of misbranded "Cancer Specific" from Missouri to District of Columbia.	Information filed; no service obtained on defendant; pending.
1041	Howe Medicine Co.	Pennsylvania, eastern district.	Shipment of misbranded headache tablets from Pennsylvania to Michigan.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 573.)
1043	The Kola Ade Co.	Georgia, northern district.	Shipment of adulterated and misbranded Kola Ade from Georgia to Tennessee.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 310.)
1045	A. J. Miller	Missouri, eastern district.	Shipment of misbranded cancer cure from Missouri to District of Columbia.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 635.)
1046	Raleigh Springs Co.	Tennessee, western district.	Shipment of adulterated water from Tennessee to District of Columbia.	Information filed summons issued, returned "not to be found."
1048	Dr. Curry Cancer Cure Co.	Ohio, southern district.	Shipment of misbranded cancer cure from Ohio to District of Columbia.	Defendant pleaded guilty and fined $50 and costs, $15.95. (Notice of Judgment No. 507.)
1052	E. J. Koechlin	Indiana	Shipment of adulterated milk from Indiana to Ohio.	Consolidated with 1013. (Notice of Judgment No. 680.)
1053	Mike Beam	do	do	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 628).
1054	Fred E. Kaiser	do	do	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 632.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1055	Paul Manufacturing Co.	Massachusetts.....	Shipment of misbranded deodorizer and germ killer from Massachusetts to District of Columbia.	Information filed; pending.
1056	Bloomingdale Bros.	New York, southern district.	Shipment of misbranded vermouth from New York to New Jersey.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 461.)
1057	Ozone Spring Water Co.	Louisiana, eastern district.	Shipment of adulterated and misbranded water from Louisiana to New York.	Information filed; pending.
1058	.....do.....	.....do.....	.....do.....	Do.
1060	American Beverage Co.	Missouri, eastern district.	Shipment of adulterated and misbranded coca cream from Missouri to Tennessee.	Do.
1061	.....do.....	.....do.....	Shipment of adulterated and misbranded "Pepsette" from Missouri to Tennessee.	Do.
1062	A. M. Laevison & Co.	Kentucky, western district.	Shipment of misbranded "Temperine" from Kentucky to Tennessee.	Do.
1063	.....do.....	.....do.....	Shipment of misbranded beverage from Kentucky to Tennessee.	Do.
1064	The Reakirt Drug Co.	Ohio, southern district.	Shipment of misbranded laudanum from Ohio to Kentucky.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 333.)
1066	Southern Drug Co.	Virginia, eastern district.	Shipment of adulterated and misbranded laudanum from Virginia to Tennessee.	Information filed; pending.
1068	Henry S. Wampole & Co.	Maryland.....	Shipment of adulterated and misbranded laudanum from Maryland to Virginia.	Defendant pleaded guilty and fined $20. (Notice of Judgment No. 226.)
1069	Fruit Puddine Co.	.....do.....	Shipment of misbranded fruit puddine from Maryland to Ohio.	Information filed pending.
1070	Acme Extract and Chemical Works.	Pennsylvania, middle district.	Shipment of misbranded "Cream-x-oel-o" from Pennsylvania to New Jersey.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 402.)
1072	Creamer Drug Co..	Massachusetts.....	Shipment of misbranded Capi Cura from Massachusetts to Michigan.	Information filed; pending.
1075	H. A. Johnson Co..	.....do.....	Shipment of misbranded jelly from Massachusetts to New York.	Defendant pleaded nolo contendere and fined $25. (Notice of Judgment No. 580.)
1076	Howe Medicine Co.	Pennsylvania, eastern district.	Shipment of misbranded headache tablets from Pennsylvania to New Jersey.	Consolidated with F. & D. Nos. 1041 and 1098, supra. (Notice of Judgment No. 573.)
1077	John D. Langham.	New York, western district.	Shipment of misbranded "Break up the Grip" tablets from New York to Michigan.	Information filed; pending.
1080	American Beverage Co.	Missouri, eastern district.	Shipment of adulterated and misbranded beverage "Pepsette" from Missouri to Kentucky.	Do.
1081	S. D. Scott & Co...	Virginia, eastern district.	Shipment of misbranded cracked corn from Virginia to North Carolina.	Do.
1082	J. F. Gearan.....	Massachusetts.....	Shipment of misbranded headache powders from Massachusetts to New Jersey.	Defendant pleaded guilty; consolidated with 926, supra. (Notice of Judgment No. 569.)
1086	Strohmeyer & Arpe Co.	New York, southern district.	Shipment of misbranded olive oil from New York to Texas.	Information filed; motion to quash sustained. (Notice of Judgment No. 565.
1088 1089	Henry Boberink..	Indiana.....	Shipment of adulterated milk from Indiana to Ohio.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 674.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district	Nature of offense charged.	Disposition or present status of case.
1090 1091 1092	Henry A. Boberink.	Indiana	Shipment of adulterated milk from Indiana to Ohio.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 673.)
1093	Phoenix Cheese Co.	New York, southern district.	Shipment of misbranded cheese from New York to Pennsylvania.	Information filed; court sustained demurrer. (Notice of Judgment No. 576.)
1094	Berry Hill Mineral Spring Co.	Virginia, eastern district	Shipment of misbranded mineral water from Virginia to District of Columbia.	Information filed; pending.
1095	Globe Elevator Co.	New York, western district.	Shipment of adulterated and misbranded gluten from New York to Pennsylvania.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 315.)
1096	Universal Stock Feed Co.	Tennessee, middle district.	Shipment of misbranded feed from Tennessee to North Carolina.	Dismissed on payment by defendant of costs $11.
1097	M. C. Peters Mill Co.	Nebraska	Shipment of adulterated and misbranded feed from Nebraska to Illinois.	Information filed; pending.
1098	Howe Medicine Co.	Pennsylvania, eastern district.	Shipment of misbranded headache treatment from Pennsylvania to New Jersey.	Consolidated with F. & D. Nos. 1041 and 1076, supra. (Notice of Judgment No. 573.)
1103	Furst Bros.	Ohio, southern district.	Shipment of misbranded "Sure Thing Tonic" from Ohio to New York.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 261.)
1105	Dr. W. J. Tucker.	Georgia, northern district.	Shipment of misbranded drug habit cure from Georgia to the District of Columbia.	Information filed; pending.
1106	S. J. Van Lill Co.	Maryland	Shipment of adulterated and misbranded peach butter from Maryland to West Virginia.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 592.)
1107	Peck Johnson Co.	Michigan, western district.	Shipment of misbranded headache powders from Michigan to Louisiana.	Leave to file information denied; pending.
1108	Kornfalfa Feed Milling Co.	Missouri, western district.	Shipment of misbranded alfalfa meal from Missouri to Virginia.	Defendant pleaded guilty; sentence suspended. (Notice of Judgment No. 608.)
1111	M. C. Peters Mill Co.	Nebraska	Shipment of misbranded horse feed from Nebraska to Georgia.	Information filed; pending.
1112	A. C. Huthwelker.	Maryland	Shipment of misbranded headache and neuralgia tablets from Maryland to Pennsylvania.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 225.)
1113	E. S. Woodworth & Co.	Minnesota	Shipment of misbranded flour from Minnesota to Virginia.	Defendant pleaded guilty and fined $5. (Notice of Judgment No. 374.)
1114	D. & L. Slade Co.	Massachusetts	Shipment of misbranded nutmeg from Massachusetts to New York.	Information filed; pending.
1116	Guthrie & Co.	Nebraska	Shipment of misbranded horse feed from Nebraska to Georgia.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 322.)
1117 1118	American Ice Co.	District of Columbia.	Adulterated ice offered for sale in the District of Columbia.	Defendant pleaded guilty and fined $150. (Notice of Judgment No. 299.)
1123	Hall-Baker Grain Co.	Missouri, western district.	Shipment of adulterated and misbranded wheat from Missouri to Texas.	Information filed; pending.
1129	Davenport Vinegar and Pickling Works.	Iowa, southern district.	Shipment of adulterated and misbranded vinegar from Iowa to Illinois.	Do.
1130	Warner - Jenkinson Co.	Missouri, eastern district.	Shipment of adulterated and misbranded apple phosphate from Missouri to Alabama.	Do.
1135	C. Henry Wilson.	Connecticut	Shipment of misbranded cancerine from Connecticut to District of Columbia.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 427.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1144	Stuart Plaster Pad Co.	Missouri, eastern district.	Shipment of misbranded adhesive hernial plaster pads from Missouri to the District of Columbia.	Court sustained demurrer to information. (Notice of Judgment No. 496.)
1148	Mrs. H. Guilmard.	New York, southern district.	Shipment of misbranded hair coloring from New York to Pennsylvania.	Defendant pleaded guilty and fined $5. (Notice of Judgment No. 434.)
1149	Sure Pop Co.....	Indiana.....	Shipment of misbranded headache powders from Indiana to Illinois.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 633.)
1152	W. A. Starnes.....	Georgia, northern district.	Shipment of misbranded drug-habit cure from Georgia to District of Columbia.	Information filed; pending.
1154	Home Fruit Co....	New York, southern district.	Shipment of misbranded jam from New York to New Jersey.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 641.)
1155	Charles Crecelius..	Indiana.....	Shipment of adulterated and misbranded cocaine from Indiana to Kentucky.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 646.)
1156	L. F. Miller & Sons	Pennsylvania, eastern district.	Shipment of adulterated and misbranded oats from Pennsylvania to Florida.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 582.)
1157	Gin-Seng-Gin Co..	Ohio, southern district.	Shipment of misbranded "Gin Seng Gin" from Ohio to Michigan.	Defendant pleaded guilty and fined $25 and costs $14.05. (Notice of Judgment No. 327.)
1158	Serafino Manfredonia.	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to Connecticut.	Information filed; pending.
1162	California Perfume Co.	.....do.....	Shipment of adulterated and misbranded lemon extract from New York to Kentucky.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 500.)
1165	Lopez Remedy Co.	Arkansas, eastern district.	Shipment of misbranded Lopez Specific from Arkansas to Missouri.	Information filed; pending.
1169	Logan, Johnson & Co.	Massachusetts.....	Shipment of misbranded raspberry apple preserves from Massachusetts to New York.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 581.)
1170	Wixon Spice Co...	Illinois, northern district.	Shipment of misbranded black pepper from Illinois to Indiana.	Defendant pleaded nolo contendere and fined $100. (Notice of Judgment No. 516.)
1173	Western Candy and Bakers Supply Co.	Missouri, eastern district.	Shipment of adulterated and misbranded orange extract from Missouri to Illinois.	Information filed; pending.
1174	National Aniline and Chemical Co.	New York, eastern district.	Shipment of adulterated and misbranded gum tragacanth from New York to New Jersey.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 572.)
1176	Zinkeisen & Co....	New York, southern district.	.....do.....	Information filed; pending.
1179	W. A. Lawrence & Son.	.....do.....	Shipment of misbranded cheese from New York to Pennsylvania.	Demurrer to information sustained. (Notice of Judgment No. 566.)
1180	The Great Atlantic and Pacific Tea Co.	New Jersey.....	Shipment of adulterated and misbranded flavoring extract from New Jersey to Texas.	Information filed; pending.
1183	Frederick Stearns & Co.	Michigan, eastern district.	Shipment of misbranded headache wafers from Michigan to Illinois.	Do.
1184	National Sales Co..	Ohio, southern district.	Shipment of adulterated and misbranded sirups from Ohio to Indiana.	Defendant pleaded guilty; fined $100 and costs $15.70. (Notice of Judgment No. 328.)
1187	Ruben L. Smith, Rutledge Medical Institute.	New York, western district.	Shipment of misbranded drug-habit treatment from New York to the District of Columbia.	Information filed; pending.

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1190	McEwen Grain Co.	Missouri, western district.	Shipment of misbranded "corn chop" from Missouri to Louisiana.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 540.)
1192	Squire Dingee Co..	Illinois, northern district.	Shipment of adulterated and misbranded catsup from Illinois to Nebraska.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 388.)
1193	National Spice Co.	New York, southern district.	Shipment of adulterated and misbranded laudanum from New York to Connecticut.	Defendant pleaded guilty and fined $50. (Notice of Jugdment No. 459.)
1194	Pullen - Richardson Chemical Co.	Missouri, eastern district.	Shipment of misbranded headache powders from Missouri to Georgia.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 428.)
1196	United Drug Co...	Illinois, northern district.	Shipment of misbranded headache wafers from Illinois to Tennessee.	Defendant pleaded nolo contendere and fined $50. (Notice of Judgment No. 569.)
1197	Cusimano & Tujague Co.	Louisiana, eastern district.	Shipment of adulterated and misbranded olive oil from Louisiana to Texas.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 514.)
1200	Kohler Manufacturing Co.	Maryland.....	Shipment of misbranded headache and neuralgia remedy from Maryland to Tennessee.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 339.)
1202	P. Duff & Sons....	Pennsylvania, western district.	Shipment of misbranded molasses from Pennsylvania to New York.	Defendant pleaded nolo contendere and fined $50 and costs, $3.85.
1203	Marchesini Bros...	New York, southern district.	Shipment of misbranded olive oil from New York to Texas.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 397.)
1211	De Trey & Sons...	Pennsylvania, eastern district.	Shipment of adulterated and misbranded drug from Pennsylvania to District of Columbia.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 571.)
1214	The Bettman-Johnson Co.	Ohio, southern district.	Shipment of adulterated and misbranded blackberry cordial from Ohio to California.	Information filed; pending.
1222	Henry H. Shufeldt & Co.	Illinois, southern district.	Shipment of adulterated and misbranded cordial from Illinois to Missouri.	Do.
1224	A. De Claremont Co. (Inc.)	New York, southern district.	Shipment of misbranded curacao from New York to Massachusetts.	Do.
1225	George P. Calogera	.....do.....	Shipment of adulterated and misbranded olive oil from New York to Georgia.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 396.)
1227	Independent Distilling Co.	Missouri, western district.	Shipment of adulterated and misbranded port wine from Missouri to Arkansas.	Information filed pending.
1230	A. M. Laevison & Co.	Kentucky, western district.	Shipment of adulterated and misbranded cream ale from Kentucky to Tennessee.	Do.
1234	H. J. Heinz Co...	Pennsylvania, western district.	Shipment of adulterated and misbranded cidar vinegar from Pennsylvania to New York.	Do.
1236	Swift & Co.....	Illinois, northern district.	Shipment of misbranded oil from Illinois to Massachusetts.	Defendant pleaded nolo contendere and fined $200 and costs. (Notice of Judgment No. 472.)
1240	Donato Maddaloni	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to New Jersey.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 535.)
1241	Lehman Rosenfeld Co.	Ohio, southern district.	Shipment of adulterated and misbranded Rococola from Ohio to Kentucky.	Defendant pleaded guilty and fined $50 and costs $14.60. (Notice of Judgment No. 466.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district	Nature of offense charged.	Disposition or present status of case.
1243	Armour & Co.....	District of Columbia.	Adulterated and misbranded canned eggs offered for sale in the District of Columbia.	Information filed; pending.
1244	California Perfume Co.	New York, southern district.	Shipment of adulterated and misbranded extracts from New York to Kentucky.	Defendant pleaded guilty and fined $10.
1249	Charles Crecelius..	Indiana.....	Shipment of adulterated and misbranded cocaine from Indiana to Kentucky.	Defendant pleaded guilty; consolidated with 1155. (Notice of Judgment No. 646.)
1253	Lucca Olive Oil Importing Co.	New York, southern district.	Shipment of misbranded oil from New York to New Jersey.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 453.)
1254	Warner-Jenkinson Co.	Missouri, eastern district.	Shipment of adulterated and misbranded sirup from Missouri to Ohio.	Information filed; pending.
1255	M. Duff & Sons...	Pennsylvania, western district.	Shipments of misbranded molasses from Pennsylvania to New York.	Defendant pleaded nolo contendere and fined $50 and costs $4. (Notice of Judgment No. 667.)
1259	St. Louis Syrup and Preserving Co.	Missouri, eastern district.	Shipment of misbranded jam from Missouri to District of Columbia.	Defendant pleaded guilty and fined $30 and costs. (Notice of Judgment No. 476.)
1262	Health Food Co...	New York, southern district.	Shipment of misbranded health food from New York to Pennsylvania.	Defendant pleaded guilty; sentence suspended. (Notice of Judgment No. 470.)
1263	Bishop & Co.....	California, southern district.	Shipment of adulterated and misbranded jam from California to Arizona.	Defendant pleaded guilty and fined $1. (Notice of Judgment No. 602.)
1269	Marchesini Bros...	New York, southern district.	Shipment of misbranded olive oil from New York to Massachusetts.	Defendant pleaded guilty. Fined $100. (Notice of Judgment No. 654.)
1270	Newmark Bros....	California, southern district.	Shipment of adulterated and misbranded lemon extract from California to Arizona.	Defendant pleaded guilty and fined $1. (Notice of Judgment No. 601.)
1272	Goetzman Bros...	Missouri, eastern district.	Shipment of adulterated and misbranded vanilla extract from Missouri to Illinois.	Information filed; pending.
1276	J. M. Bour Co.....	Ohio, northern district.	Shipment of adulterated and misbranded coffee from Ohio to Illinois.	Do.
1280	Columbia Manufacturing Co.	Illinois, northern district.	Shipment of adulterated and misbranded lemonade powders from Illinois to Pennsylvania.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 279.)
1281	Henry Sloan & Co.	New York, western district.	Shipment of adulterated frozen eggs from New York to Massachusetts.	Defendant arrested and bound over to await action of grand jury.
1283	Foote & Jenks....	Michigan, eastern district.	Shipment of adulterated and misbranded lemon flavor from Michigan to Ohio.	Information filed; plea of not guilty entered; pending.
1284	Columbia Manufacturing Co.	Illinois, northern district.	Shipments of adulterated and misbranded orangeade powders from Illinois to Pennsylvania.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 279.)
1285	William Rippey..	Ohio, southern district.	Shipment of adulterated and misbranded lemon flavor from Ohio to Kentucky.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 444.)
1286	A. J. Hilbert & Co.	Wisconsin, eastern district.	Shipment of misbranded extract of witch hazel from Wisconsin to Illinois.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 609.)
1287	William Rippey..	Ohio, southern district.	Shipment of adulterated and misbranded lemon flavor from Ohio to Kentucky.	Defendant pleaded guilty and fined $10 and costs $14.35. (Notice of Judgment No. 444.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1289	Huber & Fuhrman Drug Mills.	Wisconsin, eastern district.	Shipment of adulterated and misbranded gum tragacanth from Wisconsin to Virginia.	Information filed; defendant pleaded not guilty; pending.
1293	Western Candy and Bakers Supply Co.	Missouri, eastern district.	Shipment of adulterated and misbranded rose extract from Missouri to Illinois.	Information filed; pending.
1294	Bettman-Johnson Co.	Ohio, outhern district.	Shipment of adulterated and misbranded blackberry cordial from Ohio to Illinois.	Do.
1301	St. Louis Syrup and Preserving Co.	Missouri, eastern district.	Shipment of misbranded jam from Missouri to Oklahoma.	Information filed; pending.
1305	Leva Bros.....	New York, southern district.	Shipment of misbranded coffee from New York to Massachusetts.	Defendant pleaded guilty and fined $1. (Notice of Judgment No. 371.)
1306	John Boyle & Co..	Maryland.....	Shipment of misbranded jam from Maryland to Louisiana.	Defendant pleaded guilty and fined $20. (Notice of Judgment No. 499.)
1307	J. Maro Harriman Drug Co.	Massachusetts.....	Shipment of misbranded headache and neuralgia cure from Massachusetts to Michigan.	Defendant pleaded nolo contendere and fined $25. (Notice of Judgment No. 568.)
1308	Manierre-Yoe Syrup Co.	Illinois, northern district.	Shipment of misbranded preserves from Illinois to New York.	Information filed; pending.
1313	Joseph Middleby, jr. (Inc.)	Massachusetts.....	Shipment of misbranded raspberry and apple compound preserves from Massachusetts to Pennsylvania.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 567.)
1314	The Great Atlantic and Pacific Tea Co.	New Jersey.....	Shipment of adulterated and misbranded strawberry extract from New Jersey to Texas.	Information filed; pending.
1315	John C. Lindsay Co.	New York, southern district.	Shipment of misbranded water from New York to Pennsylvania.	Defendant pleaded guilty and fined $15. (Notice of Judgment No. 375.)
1316	G. H. Lowell & Co.	.....do.....	Shipment of misbranded butterol from New York to Pennsylvania.	Defendant pleaded guilty and fined $1. (Notice of Judgment No. 343.)
1319	Walter S. Thayer.	New Hampshire..	Shipment of adulterated milk from New Hampshire to Massachusetts.	Petition filed for leave to file information.
1320	M. P. Kitteridge..	.....do.....	Shipment of adulterated milk from New Hampshire to Massachusetts.	Do.
1325	B. H. Townsend Co.	Utah.....	Shipment of adulterated and misbranded lemon extract from Utah to Idaho.	Information filed; plea of not guilty entered; pending.
1326	Mrs. Gervaise Graham.	Illinois, northern district.	Shipment of misbranded dandruff cure from Illinois to Tennessee.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 454.)
1334	Ludlow-Robson Co.	Ohio, northern district.	Shipment of misbranded flavoring extract from Ohio to Michigan.	Defendant pleaded nolo contendere, fined $50 and costs. (Notice of Judgment No. 548.)
1336	John Burnett.....	Massachusetts.....	Shipment of adulterated and misbranded orange extract from Massachusetts to Pennsylvania.	Defendant pleaded guilty and fined $25.
1339	Asthma Remedy Manufacturing Co.	Georgia, northern district.	Shipment of misbranded drug, Az-ma-Syde from Georgia to Utah.	Information filed; pending.
1340	McHenry & Bryan.	Arkansas, western district.	Shipment of adulterated and misbranded evaporated apples from Arkansas to Oklahoma.	Defendant pleaded guilty and fined $10 and costs, $52.05.
1341	H. Rosenthal & Sons.	Ohio, southern district.	Shipment of rock candy drops and whisky from Ohio to New York.	Defendant pleaded guilty and fined $10 and costs $13.30. (Notice of Judgment No. 467.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1344	S. Gumpert & Co..	New York, southern district.	Shipment of adulterated and misbranded maple flavor from New York to Pennsylvania.	Information filed; pending.
1349	Empire State Wine Co.	New York, western district.	Shipment of misbranded wine from New York to Massachusetts.	Do.
1350	Charles M. Dexter.	Massachusetts.....	Shipment of Misbranded headache powders from Massachusetts to New York.	Defendant pleaded guilty and fined $25.
1355	Buffalo Cold Storage Co.	New York, western district.	Shipment of adulterated eggs from New York to Pennsylvania.	Defendant convicted and fined $200. (Notice of Judgment No. 482.)
1357	F. A. Burnham...	Connecticut.....	Shipment of adulterated milk from Connecticut to Massachusetts.	Defendant pleaded guilty and fined $40.
1359	St. Louis Coffee and Spice Mills.	Missouri, eastern district.	Shipment of misbranded flavoring matter from Missouri to Kansas.	Information filed; pending.
1364	Ervin A. Rice Co..	Illinois, northern district.	Shipment of adulterated and misbranded mince-meat from Illinois to New York.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 639.)
1368	St. Louis Syrup and Preserving Co.	Missouri, eastern district.	Shipment of misbranded sirup from Missouri to Texas.	Information filed; pending.
1371	Munyon Homeopathic Home Remedy Co.	Pennsylvania, eastern district.	Shipment of misbranded drugs from Pennsylvania to Massachusetts.	Do.
1377	Warner-Jenkinson Co.	Missouri, eastern district.	Shipment of adulterated and misbranded Kola from Missouri to Michigan.	Do.
1383	Munyon Homeopathic Home Remedy Co.	Pennsylvania, eastern district.	Shipment of misbranded drugs from Pennsylvania to District of Columbia.	Do.
1386	Seattle and Puget Sound Packing Co.	Washington, western district.	Shipment of adulterated and misbranded preserves from Washington to Oregon.	Defendant pleaded guilty and fined $20, costs $25.12. (Notice of Judgment No. 509.)
1387	Munyon Homeopathic Home Remedy Co.	Pennsylvania, eastern district.	Shipment of misbranded drugs from Pennsylvania to New Jersey.	Information filed; pending.
1391	Manierre-Yoe Syrup Co.	Illinois, northern district.	Shipment of misbranded apple butter from Illinois to New York.	Do.
1399	Williams Bros.....	Michigan, eastern district.	Shipment of misbranded preserves from Michigan to Oklahoma.	Defendant pleaded nolo contendere and fined $3. (Notice of Judgment No. 551).
1400	St. Louis Syrup and Preserving Co.	Missouri, eastern district.	Shipment of adulterated and misbranded preserves from Missouri to Texas.	Information filed; pending.
1404	Williams Bros. Co.	Michigan, eastern district.	Shipment of misbranded preserves from Michigan to Illinois.	Defendant pleaded nolo contendere and fined $3. (Notice of Judgment No. 554.)
1405	Bell & Co.....	New York, southern district.	Shipment of misbranded drug from New York to Ohio.	Information filed; pending.
1406	Allaire Woodward & Co.	Illinois, southern district.	Shipment of adulterated and misbranded Kamala from Illinois to California.	Do.
1408	E. R. Webster & Co.	Ohio, southern district.	Shipment of adulterated and misbranded peach extract from Ohio to Kentucky.	Defendant pleaded guilty and fined $50 and costs. (Notice of Judgment No. 520.)
1410	Williams Bros. Co.	Michigan, eastern district.	Shipment of misbranded preserves from Michigan to South Dakota.	Defendant pleaded nolo contendere and fined $3. (Notice of Judgment No. 553.)
1414	Frederick F. Ingram Co.	.....do.....	Shipment of misbranded Elixir of Cod Liver Oil from Michigan to District of Columbia.	Defendant pleaded nolo contendere and fined $5. (Notice of Judgment No. 596.)
1416	S. Gumpert & Co..	New York, southern district.	Shipment of adulterated and misbranded extract of lemon peel from New York to Texas.	Information filed; pending.

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1429	Liebenthal Brothers & Co.	Ohio, northern district.	Shipment of adulterated and misbranded wintergreen from Ohio to Pennsylvania.	Information filed; pending.
1430	F. J. Cheney & Co.	.....do.....	Shipment of misbranded catarrh cure from Ohio to District of Columbia.	Do.
1431	E. C. Flaccus & Co.	West Virginia, northern district.	Shipment of misbranded preserves from West Virginia to Maryland.	Do.
1432	P. H. Sugrue & Co.	Ohio, northern district.	Shipment of adulterated and misbranded cider vinegar from Ohio to Pennsylvania.	Do.
1435	George D. Armstrong.	New Hampshire...	Shipment of adulterated milk from New Hampshire to Massachusetts.	Complaint filed; pending.
1436	J. M. Jackson.....	.....do.....	.....do.....	Do.
1437	H. E. Spaulding..	.....do.....	.....do.....	Do.
1438	W. E. Hopkins....	.....do.....	.....do.....	Do.
1439	Almond Hill.....	.....do.....	.....do.....	Do.
1440	W. C. Wilder.....	.....do.....	.....do.....	Do.
1441	George Yeaton....	.....do.....	.....do.....	Complaint filed; plea not guilty; pending.
1442	George Blanch....	.....do.....	.....do.....	Complaint filed; pending.
1445	J. Rhinestrom & Sons Co.	Kentucky, eastern district.	Shipment of misbranded cherries from Kentucky to New York.	Information filed; pending.
1446	C. O. Terry.....	Connecticut.....	Shipment of adulterated milk from Connecticut to Massachusetts.	Defendant pleaded nolo contendere and fined $40. (Notice of Judgment No. 523.)
1447	Jonas Danielson...	.....do.....	.....do.....	Defendant pleaded nolo contendere and fined $40. (Notice of Judgment No. 528.)
1448	T. J. Atwood.....	.....do.....	.....do.....	Defendant pleaded nolo contendere and fined $40. (Notice of Judgment No. 527.)
1449	O. S. Chafee.....	.....do.....	.....do.....	Defendant pleaded nolo contendere and fined $40. (Notice of Judgment No. 524.)
1450	A. A. Bosworth...	.....do.....	.....do.....	Defendant pleaded nolo contendere and fined $40. (Notice of Judgment No. 521.)
1451	William Fitzgerald.	.....do.....	.....do.....	Defendant pleaded nolo contendere and fined $40. (Notice of Judgment No. 526.)
1452	C. L. Warner.....	.....do	.....do	Defendant pleaded nolo contendere and fined $40. (Notice of Judgment No. 525.)
1453	W. G Jennings...	.....do.....	.....do.....	Defendant pleaded nolo contendere and fined $40. (Notice of Judgment No. 522.)
1455	J. Weller Co.....	Ohio, southern district.	Shipment of adulterated and misbranded catsup from Ohio to Iowa.	Defendant pleaded guilty and fined $15 and costs, $14.95. (Notice of Judgment No. 604.)
1460	Bruce & West Manufacturing Co.	Ohio, northern district.	Shipment of adulterated and misbranded lemon extract from Ohio to Kentucky.	Information filed; pending.
1462	Bass Islands Vineyards Co.	.....do.....	Shipment of misbranded grape juice from Ohio to Colorado.	Do.
1463	Freeman Pharmacy Co.	Maine.....	Shipment of misbranded headache tablets from Maine to New York.	Information filed; plea of not guilty entered; pending
1466	Alfalfa Milling Co..	Oklahoma, western district.	Shipment of misbranded stock feed from Oklahoma to Georgia.	Information filed; pending.
1467	Liebenthal Brothers & Co.	Ohio, northern district.	Shipment of adulterated and misbranded peppermint and ginger extract from Ohio to Colorado.	Do.

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1469	Shepard Baking Powder Co.	Missouri, eastern district.	Shipment of adulterated and misbranded vanilla flavor from Ohio to North Carolina.	Information filed; pending.
1470	Bruce & West Manufacturing Co.	Ohio, northern district.	Shipment of adulterated and misbranded vanilla extract from Ohio to Kentucky.	Do.
1471	The St. Louis Syrup and Preserving Co.	Missouri, eastern district.	Shipment of misbranded preserves from Missouri to Texas	Do.
1472	Bruce & West Manufacturing Co.	Ohio, northern district.	Shipment of adulterated and misbranded lemon extract from Ohio to Michigan.	Do.
1473	.....do.....	.....do.....	Shipment of adulterated and misbranded strawberry extract from Ohio to Kentucky.	Do.
1482	Kimball Cereal Co.	Missouri, western district.	Shipment of adulterated and misbranded oats from Missouri to Arkansas.	Do.
1486	W. D. Holt.....	New Hampshire..	Shipment of adulterated milk from New Hampshire to Massachusetts.	Do.
1487	George W. Lake...	.....do.....	.....do.....	Complaint filed; plea not guilty; pending.
1493	Bruce & West.....	Ohio, northern district.	Shipment of adulterated and misbranded lemon extract from Ohio to Kentucky.	Information filed; pending.
1494	R. Hilliers Son Co.	New Jersey.....	Shipment of adulterated and misbranded henbane leaves from New Jersey to California.	Do.
1496	J. Lindsay Wells Co.	Tennessee, western district.	Shipment of misbranded cotton-seed meal from Tennessee to Indiana.	Information filed; motion to quash entered; pending.
1497	Meyer Brothers Drug Co.	Missouri, eastern district.	Shipment of adulterated and misbranded extract of lemon from Missouri to Michigan.	Information filed; pending.
1501	Symms Utah Grocery Co.	Utah.....	Shipment of adulterated and misbranded lemon extract from Utah to Nevada.	Defendant pleaded guilty and fined $25 and costs, $17.90. (Notice of Judgment No. 637.)
1507	Leroux Cider and Vinegar Co.	Ohio, northern district.	Shipment of adulterated and misbranded vinegar from Michigan to Indiana.	Information filed; pending.
1508	J. Lindsay Wells Co.	Tennessee, western district.	Shipment of adulterated and misbranded stock feed from Tennessee to North Carolina.	Do.
1510	Francesco Carrao..	New York, southern district.	Shipment of adulterated and misbranded olive oil from New York to Massachusetts.	Defendant pleaded guilty and fined $25.
1511	Williams Brothers & Co.	Michigan, eastern district.	Shipment of misbranded preserves and jelly from Michigan to Oklahoma.	Defendant pleaded nolo contendere and fined $3. (Notice of Judgment No. 552.)
1513	William Edwards Co.	Ohio, northern district.	Shipment of misbranded lemon flavor from Ohio to Michigan.	Information filed; pending.
1518	H. C. Kenison.....	New Hampshire...	Shipment of adulterated milk from New Hampshire to Massachusetts.	Complaint filed; plea not guilty; pending.
1519	C. A. Hillsgrove...	.....do.....	.....do.....	Do.
1520	C. Jowders.....	.....do.....	.....do.....	Complaint filed; pending.
1521	Bruce & West Manufacturing Co.	Ohio, western district.	Shipment of misbranded vanilla extract from Ohio to Kentucky.	Information filed; pending.
1522	J. Lindsay Wells Co.	Tennessee, western district.	Shipment of adulterated and misbranded cotton-seed feed from Tennessee to Indiana.	Information filed; motion to quash entered; pending.
1534	Leroux Cider and Vinegar Co.	Ohio, northern district.	Shipment of adulterated and misbranded catsup from Ohio to Illinois.	Information filed; pending.
1541 1542	Pressing and Orr Co.	.....do.....	Shipment of adulterated and misbranded catsup from Ohio to Maryland.	Do.
1545	St. Louis Syrup and Preserving Co.	Missouri, eastern district.	Shipment of adulterated apple butter from Missouri to Oklahoma.	Do.

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal year 1910, and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1548	Kansas City Preserving Co.	Missouri, western district.	Shipment of adulterated catsup from Missouri to Kansas.	Information filed; pending.
1553	Meyer Brothers Drug Co.	Missouri, eastern district.	Shipment of misbranded vanilla extract from Missouri to Michigan.	Do.
1563	Mountain City Mill Co.	Tennessee, eastern district.	Shipment of adulterated and misbranded feed meal from Tennessee to North Carolina.	Do.
1588	Munyon Homeopathic Home Remedy Co.	Pennsylvania, eastern district.	Shipment of misbranded drug "Vitalizer" from Pennsylvania to Maryland.	Do.
1589	Prussing Bros.....	Illinois, northern district.	Shipment of adulterated and misbranded cider vinegar from Illinois to Indiana.	Defendant pleaded guilty and fined $25 and costs, $5.10. (Notice of judgment No. 642.
1618	Hetfield Extract Manufacturing Co.	New York, southdistrict.	Shipment of adulterated and misbranded lemon flavor from New York to New Jersey.	Defendant pleaded guilty and fined $5. (Notice of judgmen, No. 622.

RECAPITULATION.

Terminated in favor of the United States:	
Defendant pleaded guilty and fined	226
Defendant pleaded guilty; sentence suspended	1
Defendant convicted and fined upon plea of not guilty	10
Defendant convicted; sentence suspended	2
Total	249
Terminated in favor of the defendant:	
Verdict in favor of defendant	3
Court sustained demurrer	4
Motion to quash sustained	1
Grand jury failed to return indictment	3
Leave to file information denied	6
Pending:	
Information or indictment filed	138
Pending in Department of Justice	252
Defendant convicted; motion in arrest of judgment	1
Motion to quash indictment sustained; Government appealed to Supreme Court	1
Motion to quash	6
Information filed; demurrer interposed	4
Information filed; demurrer argued	1
Defendant arrested; bound over to await action of grand jury	1
Total	404
Dismissed	96
Summary:	
Cases decided in favor of the United States	249
Cases decided in favor of the defendant	8
Grand jury failed to return indictment	3
Leave to file information denied	6
Cases dismissed	96
Cases pending	404
Total number of cases reported in the fiscal year 1910	766
Total amount of fines imposed	$7,858

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition or present status of the case.
633	Leroux Cider and Vinegar Co.	Illinois, northern district.	23 barrels of adulterated and misbranded vinegar shipped from Ohio to Illinois.	Decree of condemnation and forfeiture rendered; costs $18.38. (Notice of Judgment No. 168.)
636	.....	Missouri, eastern district.	3 cases of misbranded hair tonic shipped from New York to Missouri.	Libel filed; seizure effected; pending.
641	Frank Crawford...	Massachusetts.....	70 tubs of adulterated butter shipped from New York to Massachusetts.	Goods released on payment of costs and filing of bond.
642	Rigney & Co.....	Missouri, eastern district.	13 cases of adulterated and misbranded canned sirup shipped from New York to Missouri.	Judgment for the claimant. (Notice of Judgment No. 325.)
648	St. Louis Crystal Egg Co.	Minnesota.....	2 barrels of adulterated crystal eggs shipped from Missouri to Minnesota.	Decree of condemnation and forfeiture and order of destruction entered. (Notice of Judgment No. 657.)
649	.....do.....	Massachusetts.....	1 barrel of adulterated crystal eggs shipped from Missouri to Massachusetts.	Libel filed; seizure effected; pending.
650	Coleman-Tompkins & Co.	Tennessee, middle district.	26 cases of adulterated and misbranded cane sirup shipped from Alabama to Tennessee.	Decree of condemnation and forfeiture entered.
653	Leroux Cider and Vinegar Co.	.....do.....	75 packages of adulterated and misbranded vinegar shipped from Ohio to Tennessee.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 200.)
679	Corrizo Extract Co.	California, northern district.	76 bottles of adulterated and misbranded vanilla extract shipped from New York to California.	Decree of condemnation and forfeiture entered; goods released on bond. (Notice of Judgment No. 619.)
680	Spielman Brothers Co.	Nebraska.....	75 barrels of adulterated and misbranded vinegar shipped from Illinois to Nebraska.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 626.)
681	Board-Armstrong Co.	Georgia, northern district.	54 barrels of misbranded vinegar shipped from Virginia to Georgia.	Decree of condemnation and forfeiture rendered.
716	O. H. Dudley & Co.	New York, southern district.	63 cases of misbranded canned fish shipped from California to New York.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 365.)
797	Columbia Desiccated Egg Co.	District of Columbia.	6 drums of adulterated desiccated eggs shipped from Illinois to the District of Columbia.	Judgment by default; goods ordered to be destroyed. (Notice of Judgment No. 227.)
800	Andrew Rohan Co.	Ohio, southern district.	20 cases of misbranded butter shipped from Indiana to Ohio.	Libel filed; seizure effected; answer of claimant admitting facts in libel; goods released on bond. (Notice of Judgment No. 332.)
802	Connecticut Pie Co.	District of Columbia.	150 boxes of adulterated seedless raisins shipped from New York to the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 145.)
807	Henry P. Kern....	.....do.....	35 boxes of adulterated evaporated peaches shipped from Pennsylvania to the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 153.)
818	No claimant.....	Virginia, eastern district.	41 barrels of adulterated fish shipped from New York to Virginia.	Order of condemnation and destruction entered. (Notice of Judgment No. 666.)
819	.....do.....	.....do.....	.....do.....	Do.
823	.....	Illinois, northern district.	5 barrels of adulterated and misbranded witch-hazel shipped from Pennsylvania to Illinois.	Libel filed; seizure effected; pending.

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition or present status of the case.
831	.....	Pennsylvania, western district.	205 barrels of adulterated and misbranded vinegar shipped from Ohio to Pennsylvania.	Libel filed; seizure effected; pending.
834	Columbia Desiccated Egg Co.	Maryland.....	3 drums of adulterated desiccated eggs shipped from Illinois to Maryland.	Decree of condemnation and forfeiture entered; goods destroyed. (Notice of Judgment No. 305.)
836	Williams & Moorehouse.	Florida, southern district.	74 boxes of misbranded cheese shipped from Wisconsin to Florida.	Libel filed; seizure effected; pending.
866	Thomas L. Stanley.	District of Columbia.	200 bags of adulterated corn flour shipped from Ohio to the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 369.)
867	Williams & Moorehouse.	Florida, southern district.	98 boxes of misbranded cheese shipped from Illinois to Florida.	Goods released on bond.
869	Hoge & McDowell Co.	District of Columbia.	200 bags of adulterated corn flour shipped from Ohio to the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 369.)
878	.....	.....do.....	400 sacks of adulterated flour offered for sale in the District of Columbia.	Libel filed; seizure effected; pending.
881	W. Alfred Farr....	.....do.....	400 pounds of adulterated peanuts offered for sale in the District of Columbia.	Decree of condemnation and forfeiture rendered; goods destroyed. (Notice of Judgment No. 368.)
893	M. J. Doebereiner.	.....do.....	7 cases of adulterated raisins offered for sale in the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 367.)
895	John C. Ewald....	.....do.....	12 boxes of adulterated seedless raisins shipped from Pennsylvania to the District of Columbia.	Decree of condemnation and forfeiture rendered; goods destroyed. (Notice of Judgment No. 162.)
900	M. Holsbeierlein..	.....do.....	6 barrels of adulterated currants offered for sale in the District of Columbia.	Decree of condemnation and forfeiture rendered; goods destroyed. (Notice of Judgment No. 188.)
902	The Consolidated Grocery Co.	Florida, southern district.	20 half barrels of misbranded sirup shipped from Alabama to Florida.	Goods released on bond.
907	The Larrabee Flour Mill Co.	Indiana.....	410 sacks of adulterated and misbranded bleached flour shipped from Kansas to Indiana.	Libel filed; seizure effected; pending.
908	T. C. Jenkins and Board, Armstrong & Co.	Pennsylvania, western district.	90 barrels of adulterated and misbranded vinegar shipped from Virginia to Pennsylvania.	Goods released on payment of costs and filing of bond. (Notice of Judgment No. 584.)
915	John C. Berg.....	District of Columbia.	7 boxes of adulterated seedless raisins shipped from California to the District of Columbia.	Decree of condemnation and forfeiture rendered; goods destroyed. (Notice of Judgment No. 148.)
916	.....	Pennsylvania, eastern district.	18 half barrels of adulterated and misbranded blackberry cordial shipped from Illinois to Pennsylvania.	Libel filed; seizure effected; goods released on bond. (Notice of Judgment No. 612.)
924	.....	.....do.....	35 quarter barrels of adulterated and misbranded blackberry cordial shipped from Illinois to Pennsylvania.	Do.
927	O. L. Gregory.....	Texas, eastern district.	60 barrels and 2 half barrels of adulterated and misbranded vinegar shipped from Arkansas to Texas.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 587.)
930	Consolidated Grocery Co. (Incorporated.)	Florida, southern district.	110 sacks of adulterated and misbranded cotton-seed meal shipped from Tennessee to Florida.	Goods released on bond.

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition or present status of the case.
931	W. E. Beckman & Co.	Missouri, eastern district.	10 barrels of misbranded powdered milk shipped from New York to Missouri.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 273.)
937	No claimant.....	Virginia, eastern district.	1 barrel of adulterated desiccated eggs shipped from Illinois to Virginia.	Order of condemnation and destruction entered. (Notice of Judgment No. 665.)
942	Waterbury Chemical Co.	District of Columbia.	36 cases of misbranded metabolized cod-liver oil compound shipped from New York to the District of Columbia.	Decree of condemnation and forfeiture entered; claimant's appeal pending. (Notice of Judgment No. 303.)
943	No claimant.....	Virginia, eastern district.	2 drums of adulterated desiccated eggs shipped from Illinois to Virginia.	Order of condemnation and destruction entered. (Notice of Judgment No. 665.)
944	.....do.....	.....do.....	1 drum of adulterated desiccated eggs shipped from Illinois to Virginia.	Order of condemnation and destruction entered.
945	.....do.....	.....do.....	6 drums of adulterated desiccated eggs shipped from Illinois to Virginia.	Do.
946	R. H. Works & Co.	Tennessee, middle district.	200 sacks of adulterated and misbranded horse and dairy feed shipped from Minnesota to Tennessee.	Claimant filed answer admitting adulteration and misbranding; suit dismissed on payment of costs, $44.58. (Notice of Judgment No. 533.)
947	.....do.....	.....do.....	.....do	Consolidated with 946. (Notice of Judgment No. 533.)
949	No claimant.....	Pennsylvania, eastern district.	3 drums of adulterated desiccated eggs reshipped from Virginia to Pennsylvania.	Decree of condemnation and forfeiture entered; goods destroyed. (Notice of Judgment No. 613.)
954	A. H. Kuhnle & Co.	.....do.....	5 barrels of adulterated and misbranded milk flour shipped from New York to Pennsylvania.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 211.)
959	.....	.....do.....	13 cases of adulterated and misbranded olive oil shipped from New York to Pennsylvania.	Libel filed; seizure effected; goods released on bond. (Notice of Judgment No. 617.)
960	No claimant.....	Texas, northern district.	300 cases of adulterated raisins shipped from California to Texas.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 316.)
966	Coca Cola Bottling Works Co.	Tennessee, eastern district.	40 barrels and 20 kegs of adulterated and misbranded coca cola shipped from Georgia to Tennessee.	Libel filed; seizure effected; pending.
969	Great Western Cereal Co.	Pennsylvania, eastern district.	800 bags of misbranded feed product shipped from Virginia to Pennsylvania.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 468.)
974	.....	Georgia, northern district.	3 cases of adulterated and misbranded olive oil shipped from New York to Georgia.	Decree of condemnation and forfeiture entered.
990	H. J. Heinz Co....	District of Columbia.	5 cases of misbranded India relish offered for sale in the District of Columbia.	Libel filed; answer thereto pending.
991	F. P. Ventrone....	Rhode Island.....	150 cases of misbranded macaroni shipped from New York to Rhode Island.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 167.)
998	.....	Pennsylvania, eastern district.	2 barrels of adulterated desiccated eggs shipped from New York to Pennsylvania.	Decree of condemnation and forfeiture entered; goods destroyed. (Notice of Judgment No. 614.

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition or present status of the case.
1016	R. G. Charles.....	Texas, northern district.	2,000 cases of adulterated and misbranded tomatoes shipped from Maryland to Texas.	Decree of condemnation and forfeiture rendered; claimant filed writ of error; pending. (Notice of Judgment No. 555.)
1036	No claimant.....	District of Columbia.	1 barrel of adulterated evaporated eggs shipped from New York to the District of Columbia.	Judgment by default; goods destroyed. (Notice of Judgment No. 252.)
1039	P. Schminke Co...	Missouri, eastern district.	192 sacks of adulterated bleached flour shipped from Nebraska to Missouri.	Libel filed; seizure effected; pending.
1040	Bluthenthal & Bickart.	Louisiana, western district.	2 barrels of misbranded bottled gin shipped from Maryland to Louisiana.	Do.
1049	No claimant.....	Massachusetts.....	50 cans of adulterated frozen eggs shipped from Illinois to Massachusetts.	Default entered; decree of condemnation and forfeiture rendered; goods destroyed. (Notice of Judgment No. 496.)
1059	.....do.....	New York, northern district.	44 cans of adulterated frozen eggs shipped from New York to Massachusetts.	Default entered; decree of condemnation and forfeiture rendered; writ of destruction issued. (Notice of Judgment No. 224.)
1071	.....do.....	Massachusetts.....	19 cans of adulterated frozen eggs shipped from New York to Massachusetts.	Default entered; decree of condemnation and forfeiture rendered; warrant to destroy issued. (Notice of Judgment No. 494.)
1074	.....	Tennessee, Middle district.	300 sacks of misbranded cottonseed meal shipped from Alabama to Tennessee.	Dismissed on payment of costs and relabeling.
1119	Vegetarian Meat Co.	District of Columbia.	10 bags of adulterated shelled peanuts offered for sale in the District of Columbia.	Claimant pleaded guilty; decree of condemnation and forfeiture rendered; goods released on bond. (Notice of Judgment No. 253.)
1121	Seeman Brothers..	New York, southern district.	400 cases of misbranded canned tomatoes shipped from Maryland to New York.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 251.)
1126	No claimant.....	District of Columbia.	55 barrels of adulterated fish shipped from Virginia to District of Columbia.	Judgment by default; decree of condemnation and forfeiture rendered; goods destroyed. (Notice of Judgment No. 257.)
1139	W. Clarence Miller	.....do.....	60 cases of adulterated evaporated apples shipped from New York to the District of Columbia.	Claimant pleaded nolo contendere; decree of condemnation and forfeiture rendered. (Notice of Judgment No. 255.)
1140	.....	West Virginia, southern district.	50 misbranded cheeses shipped from Ohio to West Virginia.	Libel filed; seizure effected; pending.
1145 1146	C. D. Cannon Maple Co.	California, southern district.	495 cases of adulterated and misbranded sirup shipped from Illinois to California.	Do.
1150	No claimant.....	New York, southern district.	392 cases of adulterated sardines shipped from Maine to Massachusetts, thence to New York.	Default; decree of condemnation and forfeiture rendered; writ of destruction. (Notice of Judgment No. 395.)
1153	Francesco Romeo.	Massachusetts.....	450 boxes of misbranded macaroni shipped from New York to Massachusetts.	Decree of condemnation and forfeiture rendered; claimant pays costs $36.51. (Notice of Judgment No. 491.)

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition or present status of case.
1160	J. Lindsay Wells Co.	Tennessee, eastern district.	500 sacks of adulterated and misbranded stock feed shipped from Georgia to Tennessee.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 230.)
1163	Smith, Kline & French Co.	Pennsylvania, eastern district.	5 boxes of adulterated asafetida shipped from New York to Pennsylvania.	Libel filed; seizure effected; pending.
1166	No claimant.....	Illinois, northern district.	20 barrels of adulterated oysters shipped from Connecticut to Illinois.	Order of default and destruction entered. (Notice of Judgment No. 447.)
1167	D. Rothschild Grain Co.	Arkansas, eastern district.	1 car of adulterated oats shipped from Iowa to Arkansas.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 385.)
1171	.....	Pennsylvania, eastern district.	5 barrels of adulterated olives shipped from New York to Pennsylvania.	Libel filed; seizure effected; pending.
1177	Herbert P. Pillsbury.	District of Columbia.	60 bags of adulterated molasses grains stock feed shipped from Virginia to the District of Columbia.	Plea of nolo contendere; decree of condemnation and forfeiture rendered; order of destruction. (Notice of Judgment No. 256.)
1178	No claimant.....	Pennsylvania, western district.	70 cases of adulterated eggs shipped from New York to Pennsylvania.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 293.)
1185	Psaki Bros.....	Pennsylvania, eastern district.	10 barrels of adulterated olives shipped from New York to Pennsylvania.	Judgment in favor of United States. (Notice of Judgment No. 649.)
1188	George Spraul.....	Ohio, southern district.	275 cases of adulterated tomato catsup shipped from Indiana to Ohio.	Verdict in favor of claimant; Government appeal pending.
1189	Warner-Jenkinson Co.	Texas, southern district.	1 barrel of misbranded vanilla extract shipped from Missouri to Texas.	Libel filed; seizure effected; claimant's exceptions to libel overruled; decree of condemnation and forfeiture rendered; pending on writ of error to circuit court of appeals for fifth circuit, southern district of Texas.
1191	Sehon, Stephenson & Co.	West Virginia, southern district.	31 barrels of misbranded cider shipped from Kentucky to West Virginia.	Decree of condemnation and forfeiture entered. (Notice of Judgment No. 615.)
1195	Newport Mill Co..	North Carolina, western district.	700 sacks of misbranded corn meal shipped from Tennessee to North Carolina.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 358.)
1198	The Philadelphia Horse and Cattle Molasses Co.	District of Columbia.	54 barrels of adulterated molasses shipped from Pennsylvania to the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 254.)
1204	Newport Mill Co..	North Carolina, western district.	3 lots of misbranded corn meal shipped from Tennessee to North Carolina.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 358.)
1205	National Bakers Egg Co.	Pennsylvania eastern district.	1 barrel of adulterated desiccated egg shipped from New York to Pennsylvania.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 544.)
1206	Hudson Manufacturing Co.	Louisiana, eastern district.	2 barrels of adulterated and misbranded vanilla extract shipped from Illinois to Louisiana.	Libel filed; seizure effected; pending.
1208	Quaker Oats Co...	Arkansas, eastern district.	158 cases of misbranded breakfast food shipped from Illinois to Arkansas.	Decree of condemnation and forfeiture; claimant's appeal pending.
1209	No claimant.....	Maryland.....	250 cases of adulterated sardines shipped from Maine to Maryland.	Decree of condemnation and forfeiture rendered; order of destruction. (Notice of Judgment No. 283.

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition or present status of case.
1210	Rotschild Bros....	Oregon.....	20 kegs of adulterated and misbranded blackberry cordial shipped from California to Oregon.	Decree of condemnation and forfeiture rendered.
1212	Mason, Ehrman & Co.	.....do.....	35 boxes of misbranded codfish strips shipped from California to Oregon.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 506.)
1215	No claimant.....	New York, southern district.	273 cases of adulterated frozen eggs shipped from New Jersey to New York.	Decree of condemnation and forfeiture rendered.
1216	.....do.....	Arkansas, eastern district.	51 cases of adulterated and misbranded vinegar shipped from Kentucky to Arkansas.	Do.
1217	.....	.....do.....	10 barrels of adulterated and misbranded vinegar shipped from Kentucky to Arkansas.	Do.
1219	William Henning & Co.	Louisiana, eastern district.	14 barrels of adulterated and branded catsup shipped from Illinois to Louisiana....	Libel filed; seizure effected; demurrer filed; pending.
1221	Hudson Manufacturing Co.	Texas, western district.	1 barrel of adulterated and misbranded vanilla extract shipped from Illinois to Texas.	Libel filed; seizure effected; pending.
1228	No claimant.....	Ohio, southern district.	48 cartons of misbranded evaporated apples shipped from Virginia to Ohio.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 519.)
1231	J. Lindsay Wells Co.	Indiana.....	300 sacks of misbranded cotton-seed meal shipped from Tennessee to Indiana.	Decree of condemnation and forfeiture rendered.
1232	A. Russo & Co., and V. Viviano & Bros.	Illinois, northern district.	1,850 boxes of misbranded macaroni shipped from Missouri to Illinois.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 262.)
1233	Thomas Roberts & Co.	Pennsylvania, eastern district.	1,100 bags of adulterated coffee shipped from Virginia to Pennsylvania.	Libel filed; answer thereto; case heard (argued Apl. 9); goods restored. (Notice of Judgment No. 383.)
1238	No claimant.....	New York, southern district.	1,200 pounds of adulterated desiccated egg shipped from Illinois to New York.	Decree of condemnation and destruction entered. (Notice of Judgment No. 359.)
1245	Pendleton Grain Co.	Arkansas, western district.	1 car of adulterated and misbranded oats shipped from Missiouri to Arkansas.	Decree of condemnation and forfeiture rendered.
1246	H. K. Cochran....	Arkansas, eastern district.	.....do.....	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 452.)
1247	P. Pastene & Co..	Pennsylvania, eastern district.	9 barrels of adulterated olives shipped from New York to Pennsylvania.	Judgment in favor of United States. (Notice of Judgment No. 648.)
1248	Atlantic Macaroni Co.	Massachusetts.....	250 cases of misbranded macaroni shipped from New York to Massachusetts.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 487.)
1250	.....do.....	.....do.....	230 cases of misbranded macaroni shipped from New York to Massachusetts.	Do.
1252	Londonderry Spring Water Co.	District of Columbia.	33 cases of misbranded water shipped from New Hampshire to the District of Cobia.	Libel filed; seizure effected; pending.
1256	Guissippe Matalone, and V. Viviano & Bros.	Illinois, northern district.	1,750 boxes of misbranded macaroni shipped from Missouri to Illinois.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 262.)
1257	F. D. McKinniss Co.	Ohio, northern district.	40 misbranded cheeses shipped from Michigan to Ohio.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 546.)
1260	National Bakers Egg Co.	Virginia, eastern district.	1 barrel of adulterated desiccated egg shipped from Iowa to Virginia.	Libel filed; seizure effected; pending.

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1261	.....	Virginia, eastern district.	1 box of adulterated desiccated egg shipped from New York to Virginia.	Libel filed; seizure effected; pending.
1264	Bragno & Mustari, and V. Viviano & Bros.	Illinois, northern district.	1,700 boxes of misbranded macaroni shipped from Missouri to Illinois.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 262.)
1265	W. B. Walker & Sons.	Texas, western district.	400 cases of adulterated raisins shipped from California to Texas.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 596.)
1266	Hudson Manufacturing Co.	.....do.....	3 barrels of adulterated and misbranded vanilla and tonka compound shipped from Illinois to Texas.	Libel filed; seizure effected; pending.
1267	Rosenstein Bros. (Incorporated.)	Massachusetts.....	150 cases of misbranded sardines shipped from Maine to Massachusetts.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 490.)
1273	Leroux Cider and Vinegar Co.	Pennsylvania, western district.	40 barrels and 20 half barrels of adulterated and misbranded vinegar shipped from Ohio to Pennsylvania.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 621.)
1274	No claimant.....	Georgia, northern district.	44 barrels, 15 half barrels, 22 kegs, and 8 kegs of adulterated castup shipped from Kentucky to Georgia.	Decree of condemnation and destruction rendered; kegs and barrels sold to pay costs. (Notice of Judgment No. 622.)
1275	Spielman Bros. Co.	Indiana.....	9 barrels of adulterated and misbranded vinegar shipped from Illinois to Indiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 681.)
1277	No claimant.....	New York, southern district.	4 barrels of adulterated desiccated egg shipped from Illinois to New York.	Decree of condemnation and forfeiture rendered; writ of destruction issued. (Notice of Judgment No. 272.)
1278	.....do.....	North Carolina, eastern district.	100 bags of misbranded cracked corn shipped from Virginia to North Carolina.	Decree of condemnation and forfeiture rendered.
1288	Rigney & Co.....	Missouri, eastern district.	25 cases of adulterated and misbranded sugar cream shipped from New York to Missouri.	Libel filed; seizure effected; pending.
1291	.....	North Carolina, eastern district.	65 sacks of misbranded meal shipped from Virginia to North Carolina.	Decree of condemnation and forfeiture rendered.
1303	The Powell-Sanders Co. and The Inland Crystal Salt Co.	Washington, eastern district.	700 sacks of misbranded salt shipped from Utah to Washington.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 280.)
1304	No claimant.....	Massachusetts....	574 cans of adulterated frozen eggs shipped from Illinois to Massachusetts.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 492.)
1309	.....do.....	Ohio, southern, district.	12 cases of adulterated evaporated apples shipped from Virginia to Ohio.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 457.)
1310	William E. Shaeffer.	Maryland.....	17 bags of adulterated evaporated apples shipped from New York to Maryland.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 504.)
1311	.....	North Carolina, eastern district.	100 sacks of misbranded corn meal shipped from Tennessee to North Carolina.	Decree of condemnation and forfeiture rendered.
1311 w	.....	.....do.....	.....do.....	Do.
1311 x	.....	.....do.....	.....do.....	Do.
1317	Moore Bros. Co....	Ohio, northern district.	200 misbranded cheeses shipped from Michigan to Ohio.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 556.)
1321	Grape Products Co.	New York, western district.	74 cases of adulterated and misbranded grape juice shipped from Pennsylvania to New York.	Libel filed; seizure effected; demurrer overruled; pending.

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of offense charged.	Disposition or present status of case.
1328	Prussing Bros.	Indiana	45 barrels of misbranded vinegar shipped from Michigan to Indiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 304.)
1329	No claimant	Illinois, northern district.	25 gallons of adulterated oysters shipped from Connecticut to Illinois.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 481.)
1330	do	Missouri, western district.	20 gallons of adulterated oysters shipped from Connecticut to Missouri.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 475.)
1332	do	New York, southern district.	100 cases of adulterated frozen eggs shipped from Illinois to New York.	Decree of condemnation and forfeiture rendered; writ of destruction issued. (Notice of Judgment No. 377.)
1337	W. L. Adamson Co.	Ohio, southern district.	120 pails of misbranded fish shipped from Michigan to Ohio.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 306.)
1337 w	J. K. McIntire Co.	do	180 pails of misbrandod fish shipped from Michigan to Ohio.	Decree of condemnation and forfeiture rendered.
1337 x	Charles C. Higgins Co.	Ohio, southern district.	295 pails of misbranded fish shipped from Michigan to Ohio.	Do.
1345	Paul Brierre & Co., and Alart & McGuire.	Louisiana, eastern district.	17 barrels and 125 cases of adulterated and misbranded catsup shipped from New York to Louisiana.	Decree of condemnation and forfeiture rendered; catsup destroyed. (Notice of Judgment No. 599.)
1346	No claimant	New York, southern district.	1 barrel of adulterated desiccated egg shipped from Illinois to New York.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 362.)
1351		Michigan, eastern district.	25 boxes of adulterated drageés shipped from New York to Michigan.	Libel filed; seizure effected; pending.
1352		Louisiana, eastern district.	Various consignments of adulterated oats shipped from Missouri to Louisiana.	Do.
1353	John T. Gibbons	do	Adulterated oats shipped from Missouri to Louisiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 650.)
1356	O. H. Dickman & Co.	Indiana	300 pails of misbranded fish shipped from Ohio to Indiana.	Decree of condemnation and forfeiture rendered.
1358	William Edwards & Co.	Ohio, northern district.	2½ casks of adulterated olives shipped from New York to Ohio.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 560.)
1360		North Carolina, eastern district.	40 sacks of adulterated corn meal shipped from Virginia to North Carolina.	Libel filed; seizure effected; pending.
1361		do	50 sacks of adulterated corn meal shipped from Virginia to North Carolina.	Decree of condemnation and forfeiture rendered.
1362		do	95 sacks of adulterated corn meal shipped from Virginia to North Carolina.	Libel filed; seizure effected; pending.
1363		do	70 sacks of adulterated corn meal shipped from Virginia to North Carolina.	Decree of condemnation and forfeiture rendered.
1366	Oakland Vinegar and Pickle Co.	Minnesota	36 barrels of adulterated and misbranded vinegar shipped from Michigan to Minnesota.	Libel filed; seizure effected; pending.
1367		Texas, southern district.	1 barrel of adulterated and misbranded vanilla extract shipped from Illinois to Texas.	Do.

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition or present status of the case.
1372 1373 1374 1375	V. Viviano & Bros.	Illinois, northern district.	4,213 boxes of adulterated macaroni shipped from Missouri to Illinois.	Decree of condemnation and forfeiture rendered; order of destruction. (Notice of Judgment No. 658.)
1378	V. Viviano & Bros., and G. Matalone.	.....do.....	2,100 boxes of adulterated macaroni shipped from Missouri to Illinois.	Decree of condemnation and forfeiture rendered; order of destruction. (Notice of Judgment No. 658.)
1380	No claimant.....	Minnesota.....	25 boxes of misbranded bitters shipped from Illinois to Minnesota.	Decree of condemnation and destruction entered. (Notice of Judgment No. 483.)
1381	.....	Illinois, eastern district.	520 and 80 sacks of misbranded flour shipped from Nebraska to Illinois.	Libel filed; seizure effected; pending.
1384	.....	North Carolina, eastern district.	100 sacks of adulterated and misbranded corn meal shipped from Virginia to North Carolina.	Do.
1388	.....	Missouri, eastern district.	300 sacks of adulterated flour shipped from Nebraska to Missouri.	Do.
1389	Lexington Mill and Elevator Co.	Missouri, western district.	625 sacks of adulterated flour shipped from Nebraska to Missouri.	Decree of condemnation and forfeiture rendered; claimant's appeal pending.
1390	.....	Illinois, northern district.	300, 150, and 200 sacks of adulterated flour shipped from Nebraska to Illinois.	Libel filed; seizure effected; pending.
1392	.....	Louisiana, eastern district.	20 kegs of adulterated olives shipped from Italy to Louisiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 516.)
1393	Provident Chemical Works.	Massachusetts.....	1 barrel of misbranded calcium phosphate shipped from New York to Massachusetts.	Decree of condemnation and forfeiture rendered.
1394	.....do.....	.....do.....	.....do.....	Do.
1395	No claimant.....	New York, northern district.	1 drum of adulterated evaporated eggs shipped from Illinois to New York.	Do.
1397	L. Nunziato & Son.	Washington, western district.	275 cases of misbranded spaghetti shipped from California to Washington.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 493.)
1398	.....	Tennessee, middle district.	400 and 800 sacks of adulterated flour shipped from Missouri to Georgia.	Libel filed; seizure effected; pending.
1403	.....	Louisiana, eastern district.	104 kegs of adulterated olives shipped from Italy to Louisiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 526.)
1418	Bruce & West Co..	New York, northern district.	6 drums of adulterated evaporated eggs shipped from Illinois to New York.	Decree of condemnation and forfeiture rendered.
1419	The Bass Islands Vineyards Co.	Colorado.....	256 cases of misbranded grape juice shipped from Ohio to Colorado.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 450.)
1420	Samuel T. Dickinson, jr.	District of Columbia.	444 sacks of misbranded stock feed shipped from Virginia to the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 435.)
1427	.....	Colorado.....	203, 53, and 78 cases of misbranded grape juice shipped from Ohio to Colorado.	Libel filed; seizure effected; pending.
1464	.....	Louisiana, eastern district.	35 barrels and 100 cases of adulterated catsup shipped from Kentucky to Louisiana.	Do.
1474	No claimant.....	New York, southern district.	7 cans of adulterated frozen eggs shipped from Iowa to New York.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 462.)
1475	St. Louis Crystal Egg Co.	Massachusetts.....	2 barrels of adulterated desiccated egg shipped from Iowa to New York.	Libel filed; seizure effected; pending.

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal year 1910 and finally determined during the year or pending in the courts at its close—Continued.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition or present status of the case.
1499	No claimant.....	New York, eastern district.	100 cans of adulterated frozen eggs shipped from Illinois to New York.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 537.)
1505	Don A. Sanford...	District of Columbia.	144 packages of adulterated currants; 48 packages of adulterated raisins offered for sale in the District of Columbia.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 531.)
1509	Harbauer-Marleau Co.	Pennsylvania, western district.	75 barrels and 120 barrels of misbranded vinegar shipped from Ohio to Pennsylvania.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 681.)
1516	No claimant.....	New York, eastern district.	100 cans of adulterated frozen eggs shipped from Illinois to New York.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 537.)
1530	The Dannemiller Coffee Co., and the Graham Grocery Co.	Virginia, western district.	10 cases of misbranded coffee shipped from New York to Virginia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 545.)
1535	.....	Wisconsin, eastern district.	50 barrels of adulterated and misbranded vinegar shipped from Illinois to Wisconsin.	Libel filed; seizure effected; pending.
1549	No claimant.....	New York, southern district.	48 bales of adulterated cloves delivered for shipment from New York to Ohio.	Decree of condemnation and destruction rendered. (Notice of Judgment No. 529.)
1556	.....	Louisiana, eastern district.	2 drums of adulterated desiccated egg shipped from Illinois to Louisiana.	Libel filed; seizure effected; pending.
1586	Leroux Cider and Vinegar Co.	Pennsylvania, western district.	33 barrels and 16 half barrels of adulterated and misbranded vinegar shipped from Ohio to Pennsylvania.	Decree of condemnation and forfeiture entered. (Notice of Judgment No. 685.)
1591	.....	Louisiana, eastern district.	100 cases of adulterated tomato puree shipped from Kentucky to Louisiana.	Libel filed; seizure effected; pending.
1592	.....	.....do.....	192 cases of adulterated tomato pulp shipped from Maryland to Louisiana.	Do.
1602	.....	Georgia, northern district.	48 boxes of misbranded cloves shipped from New York to Georgia.	Do.
1607	No claimant.....	District of Columbia.	15 boxes of misbranded macaroni shipped from Pennsylvania to District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 600.)
1608	.....	Michigan, eastern district.	17 boxes of misbranded sugar shipped from Ohio to Michigan.	Libel filed; seizure effected; pending.
1626	.....	Tennessee, western district.	542 sacks of adulterated corn bran shipped from Kentucky to Tennessee.	Do.
1629	.....	Mississippi, northern district.	812 cases of adulterated sardines shipped from Massachusetts to Mississippi.	Do.
1635	.....	Texas, southern district.	50 cases of adulterated sardines shipped from New York to Texas.	Do.

RECAPITULATION.

Pending:		
Libel filed, seizure effected	46	
Decree of condemnation and forfeiture; pending on writ of error	1	
Verdict in favor of claimant; Government's appeal	1	
Decree of condemnation and forfeiture; claimant's appeal	1	
Libel filed; seizure effected; claimant's exceptions to libel overruled; decree of condemnation and forfeiture rendered; pending on writ of error to circuit court of appeals	1	
Total		50
Terminated in favor of the United States:		
Decree of condemnation and forfeiture	132	
Goods released on bond	4	
Total		136
Dismissed		12
Terminated in favor of claimant		3
Total number of cases		201

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal years 1908 and 1909, and finally determined during the fiscal year 1910.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of the case.
30	C. B. Woodworth Sons Co.	New York, western district.	Shipment of adulterated and misbranded vanilla extract from New York to Ohio.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 5.)
32	Heakin Spice Co..	Ohio, southern district.	Shipment of adulterated and misbranded vanilla flavor from Ohio to Kentucky.	Defendant pleaded guilty and fined $5 and costs. (Notice of Judgment No. 48.)
84	J. Roach Abell....	District of Columbia.	Offer for sale of misbranded cocaine in the District of Columbia.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 10.)
99	Nave McCord Mercantile Co.	Missouri, western district.	Shipment of misbranded lemon extract from Missouri to Kansas.	Defendant convicted; fined $200 and costs; writ of error allowed; pending.
118	W. G. Dean & Son.	New York, southern district.	Shipment of adulterated and misbranded black pepper from New York to District of Columbia.	Defendant pleaded guilty; sentence suspended. (Notice of Judgment No. 158.)
121	Edward Westen Tea and Spice Co.	Missouri, eastern district.	Shipment of adulterated and misbranded lemon extract from Missouri to Kansas.	Defendant convicted and fined $100. (Notice of Judgment No. 194.)
162	H. Boeckman.....	New York, eastern district.	Shipment of adulterated and misbranded honey from New York to New Jersey.	Information filed; demurrer sustained; pending on appeal. (Notice of Judgment No. 269.)
177	John A. Tolman Co.	Illinois, northern district.	Shipment of misbranded maple sirup from Illinois to Iowa.	Motion in arrest of judgment denied; defendant convicted and fined $50. (Notice of Judgment No. 271.)
194	Haynor Manufacturing Co.	Virginia, eastern district.	Shipment of adulterated and misbranded lemon extract from Virginia to North Carolina.	Defendant convicted; motion in arrest of judgment and for new trial pending.
197	Elgin Creamery Co.	District of Columbia.	Offer for sale of adulterated and misbranded butter in District of Columbia.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 42.)
220	Rigney & Co.....	New York, eastern district.	Shipment of adulterated and misbranded maple sirup from New York to Missouri.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 403.)
243	The Edward Westen Tea and Spice Co.	Missouri, eastern district.	Shipment of adulterated and misbranded lemon extract from Missouri to Indian Territory.	Defendant convicted and fined $50. (Notice of Judgment No. 194.)
253	S. W. Weidler Co.	Ohio, southern district.	Shipment of misbranded meal from Ohio to Virginia.	Defendant pleaded guilty and fined $5; costs, $17.85. (Notice of Judgment No. 170.)
274	Nathan Tucker.....	.....do.....	Shipment of misbranded drug asthma specific from Ohio to District of Columbia.	Verdict in favor of Government; motion in arrest of judgment and new trial pending.
283	Audubon Canning Co.	Iowa, southern district.	Shipment of misbranded canned corn from Iowa to Utah.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 432.)
286	A. J. Hilbert & Co.	Wisconsin, eastern district.	Shipment of misbranded lemon extract from Wisconsin to Minnesota.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 141.)
310	P. Hohenadel, jr., Co.	Illinois, northern district.	Shipment of misbranded peas from Illinois to Indiana.	Defendant pleaded guilty and fined 1 cent. (Notice of Judgment No. 321.)
311	D. B. Scully Sirup Co.	.....do.....	Shipment of misbranded maple sirup from Illinois to Washington.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 290.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal years 1908 and 1909, and finally determined during the fiscal year 1910—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of the case.
316	W. G. Dean & Sons.	New York, southern district.	Shipment of adulterated and misbranded pepper from New York to Washington.	Defendant pleaded guilty; sentence suspended. (Notice of Judgment No. 158.)
318	Forbes Brothers Tea and Spice Co.	Missouri, eastern district.	Shipment of adulterated and misbranded lemon extract from Missouri to Mississippi.	Defendant convicted and fined $400. (Notice of Judgment No. 339.)
334	.....do.....	.....do.....	Shipment of adulterated and misbranded lemon extract from Missouri to Texas.	Consolidated with 318 and 341. (Notice of Judgment No. 339.)
341	.....do.....	.....do.....	Shipment of adulterated and misbranded strawberry extract from Missouri to Mississippi.	Consolidated with 318 and 334. (Notice of Judgment No. 339.)
342	W. G. Dean & Son.	New York, southern district.	Shipment of adulterated and misbranded pepper from New York to Washington.	Defendant pleaded guilty and sentence suspended. (Notice of Judgment No. 158.)
349	The King Cereal and Manufacturing Co.	Illinois, northern district.	Shipment of adulterated and misbranded flour from Illinois to Ohio.	Defendant pleaded guilty and fined $10. (Notice of Judgment No. 317.)
353	Marshalltown Syrup and Sugar Co.	Iowa, southern district.	Shipment of misbranded sirup from Iowa to Nebraska.	Defendant pleaded guilty and fined $20. (Notice of Judgment No. 469.)
418	R. E. Funsten Dried Fruit and Nut Co.	Missouri, eastern district.	Shipment of misbranded evaporated apples from Missouri to Ohio.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 161.)
422	Clinton Sugar Refining Co.	Iowa, southern district.	Shipment of misbranded gluten feed from Iowa to New York.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 391.)
429	R. E. Funsten Dried Fruit and Nut Co.	Missouri, eastern district.	Shipment of misbranded dried apples from Missouri to Indiana.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 161.)
436	Wisconsin Butter and Cheese Co.	Wisconsin, eastdistrict.	Shipment of adulterated milk from Wisconsin to Illinois.	Defendant pleaded guilty and sentence suspended. (Notice of Judgment No. 206.)
437	.....do.....	.....do.....	.....do.....	Do.
438	William Huff.....	.....do.....	.....do.....	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 423.)
458 459	French Silver Dragee Co.	New York, southern district.	Shipment of adulterated confectionery from New York to California.	Circuit court reversed; circuit court of appeals decided in favor of defendant. (Notice of Judgment No. 249.)
481	S. J. Van Lill Co..	Maryland.....	Shipment of adulterated and misbranded tomato catsup from Maryland to Massachusetts.	Defendant pleaded guilty and fined $150. (Notice of Judgment Judgment No. 156.)
483	Price & Lucas Cider and Vinegar Co.	Pennsylvania, western district.	Shipment of adulterated and misbranded vinegar from Pennsylvania to Ohio.	Defendant convicted and fined $50; costs, $22.70. (Notice of Judgment No. 240.)
494	Hanley & Kinsella Coffee and Spice Co.	Missouri, eastern district.	Shipment of adulterated and misbranded pepper from Missouri to Texas.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 210.)
495	Calumet Tea and Coffee Co.	Illinois, northern district.	Shipment of adulterated and misbranded pepper from Illinois to Montana.	Defendant fined $50. (Notice of Judgment No. 288.)
502	Atwood & Steele Co.	Illinois, northern district.	Shipment of adulterated and misbranded lemon extract from Illinois to Idaho.	Defendant pleaded nolo contendere and fined $11.30. (Notice of Judgment No. 313.)
505	W. B. Gloofke Co..	Oregon.....	Shipment of adulterated and misbranded sirup from Washington to Oregon.	Defendant pleaded guilty and fined $25.

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal years 1908 and 1909, and finally determined during the fiscal year 1910—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of the case.
516	Charles L. Heinle Specialty Co.	Pennsylvania, eastern district.	Shipment by vendees of defendant guarantor of adulterated and misbranded vanilla extract from Pennsylvania to Delaware.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 389.)
521	Marshalltown Syrup and Sugar Co.	Iowa, southern district.	Shipment of misbranded sirup from Iowa to Colorado.	Consolidated with 353. (Notice of Judgment No. 469.)
542	Newton Tea and Spice Co.	Ohio, southern district.	Shipment of adulterated and misbranded pepper from Ohio to Mississippi.	Defendant convicted; motion for new trial pending.
552	Muscatine French Cheese Co.	Iowa, southern district.	Shipment of misbranded cheese from Iowa to Illinois	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 431.)
557	O. L. Gregory Vinegar Co.	Alabama, northern district.	Shipment of adulterated and misbranded vinegar from Alabama to Georgia.	Defendant pleaded guilty and fined $25 and costs.
559	Dennis Rupert Dupuis.	Missouri, eastern district.	Shipment of misbranded drug (Radol) from Missouri to District of Columbia.	Defendant pleaded guilty and fined $50 and costs. (Notice of Judgment No. 184.)
571	Bertin & Leporl...	California, northern district.	Shipment of adulterated and misbranded olive oil from California to New Mexico.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 417.)
586	Wiseola Co.....	Alabama, northern district.	Shipment of misbranded sirup from Alabama to Louisiana.	Defendant pleaded guilty and fined $25 and costs. (Notice of Judgment No. 594.)
591	Athens Bottling Works.	Georgia, northern district.	Shipment of misbranded cafe coca from Georgia to Louisiana.	Defendant fined $5 and costs. (Notice of Judgment No. 235.)
593	Acme Mills Co....	Oregon.....	Shipment of adulterated and misbranded gluten flour from Oregon to Washington.	Defendant pleaded guilty and fined $25. (Notice of Judgment No. 250.)
594	F. H. Finley & Son.	District of Columbia.	Offer for sale of adulterated water in the District of Columbia.	Defendant convicted and fined $10. (Notice of Judgment No. 175.)
607	John A. Falck Co..	New Jersey.....	Shipment of misbranded headache cure from New Jersey to Pennsylvania.	Defendant pleaded non vult and sentence suspended. (Notice of Judgment No. 418.)
609	The Dow & Snell Co.	Ohio, northern district.	Shipment of adulterated and misbranded spirits of camphor from Ohio to Michigan.	Defendant pleaded nolo contendere and fined $25 and costs. (Notice of Judgment No. 550.)
610	H. F. Kaufman & Co.	New York, southern district.	Shipment of adulterated and misbranded drug (damiana) from New York to Maryland.	Defendant pleaded guilty to adulteration; nol. pros. as to misbranding; fined $100. (Notice of Judgment No. 245.)
611	Baker Preserving Co.	Colorado.....	Shipment of adulterated and misbranded sirup from Colorado to Nebraska.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 209.)
612	A. L. Pillsbury, jr.	Louisiana, eastern district.	Shipment of misbranded coke extract from Louisiana to Tennessee.	Defendant pleaded guilty and fined $10 and costs. (Notice of Judgment No. 236.)
613	Koca Nola Co.....	Georgia, northern district.	Shipment of adulterated and misbranded Koca Nola from Georgia to the District of Columbia.	Defendant convicted and fined $50. (Notice of Judgment No. 202.)
616	Steinhardt Bros. & Co.	New York, southern district.	Shipment of misbranded damiana from New York to Massachusetts.	Defendant convicted and fined $200. (Notice of Judgment No. 501.)
617	McIlvaine Bros....	Pennsylvania, eastern district.	Shipment of adulterated and misbranded colocynth from Pennsylvania to Michigan.	Defendant pleaded non vult contendere and fined $10. (Notice of Judgment No. 390.)

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Cases under the food and drugs act of June 30, 1906, reported for criminal prosecution during the fiscal years 1908 and 1909, and finally determined during the fiscal year 1910—Continued.

F. & D. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of the case.
618	McIlvaine Bros...	Pennsylvania, eastern district.	Shipment of adulterated and misbranded colocynth from Pennsylvania to Texas.	Consolidated with 617 and 661.
620	F. A. Thompson & Co.	Michigan, eastern district.	Shipment of misbranded asafoetida from Michigan to Illinois.	Defendant pleaded nolo contendere and fined $10. Notice of Judgment No. 157.)
621	Bertin & Lepori...	California, northern district.	Shipment of misbranded oil from California to Washington.	Defendant pleaded guilty and fined $100. (Notice of Judgment No. 417.)
622	The Failing-Nellis Drug Co.	New York, northern district.	Shipment of misbranded headache cure from New York to Michigan.	Defendant pleaded guilty and fined $125. (Notice of Judgment No. 624.)
626	Parrish Bros. (Incorporated).	Maryland.....	Shipment of misbranded pepper from Maryland to Virginia.	Defendant pleaded guilty and fined $50. (Notice of Judgment No. 159.)
627	Frederick Stearns & Co.	Michigan, eastern district.	Shipment of misbranded extract of damiana from Michigan to Tennessee.	Defendant pleaded nolo contendere and fined $5. (Notice of Judgment No. 345.)

RECAPITULATION.

Cases terminated in favor of the United States	60
Cases terminated in favor of the defendant	1
Total	61

Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal years 1908 and 1909 and finally determined during the fiscal year 1910.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition of the case.
115	Knowlton Danderine Co.	West Virginia, northern district.	65 cases of misbranded drug shipped from Michigan to West Virginia.	Judgment for claimant; circuit court of appeals affirmed lower court. (Notice of Judgment No. 284.)
153 154	C. E. Coe.....	Arkansas, eastern district.	779 cases of misbranded molasses shipped from Tennessee to Arkansas.	Verdict for defendant; affirmed by circuit court of appeals.
163	Wichita Wholesale Grocery Co.	Kansas.....	285 cases misbranded canned tomatoes and 145 cases of misbranded canned peas shipped from Indiana to Kansas.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 542.)
175	Bouvier Specialty Co.	District of Columbia.	109 cases of misbranded drug, "Buchu Gin," shipped from Kentucky to the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 160.)
188	Getz Bros.....	California, northern district.	900 cases of misbranded canned corn shipped from Iowa to California.	Defendant paid costs, $8.40; goods released on $1,000 bond; no decree entered. (Notice of Judgment No. 440.)
208	Hecker-Jones-Jewell Milling Co.	District of Columbia.	525 cases of misbranded buckwheat flour shipped from New York to the District of Columbia.	Bond filed; costs paid; goods released.
210	Parrott & Co.....	California, northern district.	5,995 cases of misbranded canned pineapples shipped from Hawaii to California.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 436.)

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal years 1908 and 1909 and finally determined during the fiscal year 1910—Cont'd.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition of the case.
233	H. F. Allen.....	California, northern district.	1,000 sacks of misbranded flour shipped from Oregon to California.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 439.)
234	C. A. Hatton Flour Co.	.....do.....	300 sacks of misbranded flour shipped from Oregon to California.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 443.)
271	MacLaren Imperial Cheese Co.	Pennsylvania, eastern district.	85 cases of adulterated cheese shipped from Maryland to Pennsylvania.	Goods released on bond.
287	Lee, Cady & Smart	Michigan, eastern district.	50 cases of misbranded Mapleine shipped from Ohio to Michigan.	Decree of condemnation and forfeiture rendered.
287a	C. Elliott & Co.....	.....do.....	16 cases of misbranded Mapleine shipped from Ohio to Michigan.	Do.
289	Charles Foehney..	Louisiana, eastern district.	11 barrels of misbranded whisky shipped from Virginia to Louisiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 361.)
382	Western Reserve Syrup Co.	Illinois, eastern district.	48 cases of adulterated and misbranded sirup shipped from Ohio to Illinois.	Court sustained demurrer to libel. (Notice of Judgment No. 283.)
447	Smith Bros. & Burdeck Co.	Iowa, southern district.	900 cases of misbranded canned peas shipped from Wisconsin to Iowa.	Bond filed; costs paid; goods released.
450	Ritchie & Co.....	Arkansas, western district.	26 barrels of misbranded vinegar shipped from Kentucky to Illinois.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 373.)
451	Joseph Speidel Grocery Co.	West Virginia, northern district.	80 barrels of misbranded vinegar shipped from Ohio to West Virginia.	Bond given for destruction of goods.
478	B. S. Snow & Co...	Massachusetts.....	150 cases of misbranded canned blueberries shipped from Maine to Massachusetts.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 488.)
500	Hipolite Egg Co...	Illinois, southern district.	50 cases of adulterated eggs shipped from Missouri to Illinois.	Libel filed; seizure effected; decree of condemnation, forfeiture, and destruction rendered; appealed to Supreme Court of the United States.
501	Musolino & Berger.	Massachusetts.....	2 barrels of misbranded olive oil shipped from Pennsylvania to Massachusetts.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 489.)
508	S. H. Beller Grocery Co.	Missouri, western district.	78 cases of misbranded canned sirup shipped from Illinois to Missouri.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 458.)
509	Oakland Vinegar and Pickle Co.	West Virginia, northern district.	68 barrels of adulterated and misbranded vinegar shipped from Michigan to West Virginia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 688.)
528	Morris Spiegel.....	Georgia, northern district.	3 cases of misbranded beaver oil shipped from New York to Georgia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 239.)
537	A. E. Beitzel.....	District of Columbia.	10 cases of misbranded Buchu gin shipped from New York to the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 134.)
546	Oakland Vinegar and Pickle Co.	Ohio, northern district.	25 barrels of adulterated and misbranded vinegar shipped from Michigan to Ohio.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 193.)
555	No claimant.....	Alabama, middle district.	26 barrels of misbranded vinegar shipped from Kentucky to Alabama.	Decree of condemnation and forfeiture rendered; order of destruction. (Notice of Judgment No. 169.)
574	Gross, Kelly & Co.	New Mexico.....	46 cases of misbranded sirup shipped from Nebraska to New Mexico.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 302.)

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal years 1908 and 1909 and finally determined during the fiscal year 1910—Cont'd.

F. & D. case No.	Claimant.	Judicial district.	Nature of the case.	Disposition of the case.
580	Woodrow & Lewis.	New York, southern district.	400 cases of canned baking powder shipped from Pennsylvania to New York.	Decree of condemnation, forfeiture, and destruction rendered. (Notice of Judgment No. 364.)
588	Goddard Grocery Co.	Missouri, eastern district.	42 barrels of adulterated and misbranded vinegar shipped from Ohio to Missouri.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 274.)
589	Quaker Oats Co...	Georgia, southern district.	350 sacks of adulterated and misbranded feed shipped from Maryland to Georgia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 171.)
590	S. H. Levin's Sons.	Pennsylvania, eastern district.	2,300 packages of misbranded canned tomatoes shipped from Delaware to Pennsylvania.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 455.)
595	.....	California, northern district.	50 cases of misbranded wine shipped from Colorado to California.	Goods released on bond.
596	French Lick Springs Hotel.	Maryland.....	34 cases of misbranded mineral water shipped from Indiana to Maryland.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 121.)
597	Consolidated Grocery Co.	Florida, southern district.	1,500 sacks of misbranded oats shipped from Pennsylvania to Florida.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 334.)
598	Harbauer-Marleau Co.	Illinois, northern district.	60 barrels of adulterated and misbranded vinegar shipped from Ohio to Illinois.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 187.)
599	Radams Microbe Killer Co.	Washington, western district.	25 cases of misbranded Radams Microbe Killer shipped from California to Washington.	Decree of condemnation, forfeiture, and destruction rendered. (Notice of Judgment No. 623.)
600	Asheville Grocery Co.	North Carolina, western district.	120 sacks of adulterated and misbranded cotton-seed meal shipped from Tennessee to North Carolina.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 179.)
601	Bradfield Regulator Co.	Louisiana, eastern district.	27 cases of misbranded Mother's Friend shipped from Georgia to Louisiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 203.)
602	.....do.....	Missouri, eastern district.	57 cases of misbranded Mother's Friend shipped from Georgia to Missouri.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 366.)
603	No claimant.....	District of Columbia.	12 cases of misbranded Radams Microbe Killer shipped from New York to the District of Columbia.	Decree of condemnation, forfeiture, and destruction rendered. Notice of Judgment No. 205.)
604	Philip G. Affleck..	.....do.....	2½ gross of misbranded Make-Man Tablets offered for sale in the District of Columbia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 201.)
606	I. R. Howard.....	Indiana.....	200 cases of misbranded canned apricots shipped from California to Indiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 330.)
614	No claimant.....	Maryland.....	200 sacks of adulterated and misbranded molasses grains shipped from Virginia to Maryland.	Decree of condemnation, forfeiture, and destruction rendered. (Notice of Judgment No. 174.)
615	Bradfield Regulator Co.	Missouri, eastern district.	36 cases of misbranded Mother's Friend shipped from Georgia to Missouri.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 366.)
624	Libby, McNeil & Libby.	Louisiana, eastern district.	200 cases of misbranded condensed milk shipped from Illinois to Louisiana.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 223.)
631	Alabama-Georgia Syrup Co.	Tennessee, western district.	427 cases of misbranded alaga sirup shipped from Alabama to Tennessee.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 127.)

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Cases under section 10 of the food and drugs act of June 30, 1906, reported during the fiscal years 1908 and 1909 and finally determined during the fiscal year 1910—Cont'd.

F. & D. case No.	Claimant.	Judicial district.	Nature of offense charged.	Disposition of the case.
633	S. Peterson & Co..	Illinois, northern district.	23 barrels of adulterated and misbranded cider vinegar shipped from Ohio to Illinois.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 168.)

RECAPITULATION.

Cases terminated in favor of the United States:		
Decree of condemnation and forfeiture	43	
Goods released on bond	5	
		48
Cases terminated in favor of claimant		3
Total		51

Suits for breach of conditions of bonds filed by claimants in proceedings under section 10 of the food and drugs act of June 30, 1906, determined during the fiscal year 1910.

F. & D. case No.	Obligor.	Judicial district.	Cause of action.	Disposition of the case.
23a	J. G. Dorn and Thomas F. Cunningham.	Louisiana, eastern district.	Disposing of wine previously condemned for adulteration and misbranding in violation of terms of bond filed by claimant to secure its delivery to him.	Court directed verdict and signed judgment in favor of the United States for $1,000, with 5 per cent interest from June 16, 1908.
97	Climax Coffee and Baking Powder Co. and American Surety Co.	Ohio, southern district.	Disposing of coffee previously condemned for misbranding in violation of terms of bond filed by claimant to secure redelivery to it.	Judgment in favor of the United States; damages assessed at $200 and costs $21.86.

Cases terminated in favor of the United States 2

CASES REPORTED BY DEPARTMENT COLLABORATORS.

Increased efficiency in cooperation with the Department by local health, food, and drug officers of the States and the District of Columbia, acting under commissions issued by the Secretary of Agriculture, manifested itself during the year. In January carefully drawn instructions were sent to each commissioned state official, explaining the requirements to be observed in the preparation of cases and methods to be employed in the collection of samples. Beginning with number 123, advance copies of each notice of judgment have been furnished to such officials and they now receive information of all decisions of courts in cases arising under the act as soon as the information is available. The endeavor has been to interest the health, food and drug officers of the States and the District of Columbia in the enforcement of the act, and the results obtained appear in the following tables:

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Cases under section 2 of the food and drugs act of June 30, 1906, reported to United States attorneys by collaborators of the Department and finally determined during the fiscal year 1910.

F. & D. case No.	Defendant.	Judicial district.	Offense charged.	Disposition of the case.
29c	W. H. Harrison & Co.	Ohio, southern district.	Misbranded lemon flavor shipped from Ohio to Kentucky.	Defendant pleaded nolo contendere; fined $5 and costs, $24.16. (Notice of Judgment No. 281.)
34c	Elijah E. Blough..	District of Columbia.	Adulterated cream shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 186.)
35c	Samuel C. Harley.	.....do.....	.....do.....	Do.
36c	Hugh Wallis.....	.....do.....	Adulterated and misbranded ice cream offered for sale in District of Columbia.	Defendant pleaded guilty; fined $25. (Notice of Judgment No. 213.)
37c	Robert E. Kanode.	.....do	Adultered milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 214.)
38c	David T. Stup....	.....do.....	.....do.....	Defendant pleaded guilty; fined $15. (Notice of Judgment No. 214.)
39c	Newton Tea and Spice Co.	Ohio, southern district.	Misbranded strawberry extract shipped from Ohio to Kentucky.	Defendant pleaded guilty; fined $10 and costs, $19.35. (Notice of Judgment No. 390.)
40c	William W. Soper.	District of Columbia.	Adulterated milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $15. (Notice of Judgment No. 228.)
41c	Charles A. Walter.	.....do.....	.....do.....	Defendant pleaded guilty; fined $15. (Notice of Judgment No. 229.)
42c	Lyman T. Robinson.	.....do.....	Adulterated milk shipped from Virginia to District of Columbia (2 shipments).	Defendant pleaded guilty; fined $30—$15 for each offense. (Notice of Judgment No. 214.)
43c	George R. Reeves.	.....do.....	Adulterated milk shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $15. (Notice of Judgment No. 214.)
44c	Albert Mack.....	.....do.....	.....do.....	Defendant pleaded guilty; fined $15. (Notice of Judgment No. 214.)
45c	Samuel C. Harley.	.....do.....	Adulterated cream shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $15. (Notice of Judgment No. 241.)
46c	Arthur Swart.....	.....do.....	Adulterated milk shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 264.)
49c	Washington B. Chichester.	.....do.....	Adulterated milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 265.)
50c	Nettie Carr.....	.....do.....	.....do.....	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 267.)
51c	Lynden W. Howard.	.....do.....	Adulterated cream shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 268.)
52c	William C. Null...	.....do.....	Adulterated milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 287.)
53c	S. A. Thomas.....	.....do.....	Adulterated cream shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 285.)

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Cases under section 2 of the food and drugs act of June 30, 1906, reported to United States attorneys by collaborators of the Department and finally determined during the fiscal year 1910—Continued.

F. & D. case No.	Defendant.	Judicial district.	Offense charged.	Disposition of the case.
54c	George L. Hilderbrand.	District of Columbia.	Adulterated milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 312.)
55c	Samuel C. Harley.	do	Adulterated cream shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 308.)
56c	John Irvine	do	do	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 307.)
57c	Thomas F. Myers.	do	Adulterated cream shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 336.)
59c	Edgar W. Feaster.	do	do	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 338.)
60c	George P. Altman.	do	Adulterated milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $5. (Notice of Judgment No. 347.)
61c	Laban B. Armstrong.	do	do	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 335.)
62c	William D. Zimmerman.	do	do	Defendant pleaded guilty; fined $10.
64c	Albert A. Boyer.	do	Adulterated cream shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 425.).
65c	George W. Bosley.	do	do	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 331.)
66c	Ben White	do	do	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 430.)
67c	Joseph W. Bischof.	do	Adulterated and misbranded ice cream offered for sale in the District of Columbia.	Court instructed jury to bring in verdict of not guilty. (Notice of Judgment No. 438.)
68c	John H. Allnutt.	do	Adulterated cream shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 445.)
69c	James Kelley & Son.	do	Adulterated cream shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 446.)
70c	George M. Kephart.	do	Adulterated cream shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 451.)
71c	Horace H. Smith.	do	Adulterated milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 460.)
72c	Charles H. Dixon.	do	Adulterated cream shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 479.)
73c	Lawrence B. Jones	do	Adulterated milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 502.)
74c	Charles M. Parks.	do	Adulterated cream shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 484.)

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Cases under section 2 of the food and drugs act of June 30, 1906, reported to United States attorneys by collaborators of the Department and finally determined during the fiscal year 1910—Continued.

F. & D. case No.	Defendant.	Judicial district.	Offense charged.	Disposition of the case.
75c	William M. Thompson.	District of Columbia.	Adulterated cream shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 485.)
76c	Edwin M. Horine.	.....do.....	Adulterated milk shipped from Maryland to District of Columbia.	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 503.)
77c	George A. Willson.	.....do.....	.....do.....	Defendant pleaded guilty; fined $5. (Notice of Judgment No. 538.)
78c	George L. Hilderbrand.	.....do.....	.....do.....	Defendant pleaded guilty; fined $10. (Notice of Judgment No. 557.)
80c	Arthur Swart.....	.....do.....	Adulterated cream shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $10; (Notice of Judgment No. 558.)
82c	Albert Mack.....	.....do.....	Adulterated milk shipped from Virginia to District of Columbia.	Defendant pleaded guilty; fined $20. (Notice of Judgment No. 590.)

RECAPITULATION.

Cases terminated in favor of the United States	43
Cases terminated in favor of defendant	1
Total	44
Fines	$490.00
Costs	$43.51

Cases under section 10 of the food and drugs act of June 30, 1906, reported to United States attorneys by collaborators of the Department during the fiscal year 1910.

F. & D. case No.	Claimants.	Judicial district.	Subject of offense.	Disposition or status the case.
30c	The Robinson Cider and Vinegar Co.	Kansas.....	78 casks of misbranded vinegar shipped from Michigan to Kansas.	Costs paid; goods released on $1,000 bond. (Notice of Judgment No. 207).
31c	J. Lindsay Wells Co.	Tennessee, middle district.	300 sacks of misbranded cottonseed meal shipped from Kentucky to Tennessee.	Case dismissed on payment of costs and relabeling of goods.
33c	Interstate Warehouse and Elevator Co.	Georgia, northern district.	2 carloads of adulterated oats shipped from Missouri to Georgia.	Decree of condemnation and forfeiture rendered. (Notice of Judgment No. 101.)
47c	.....	.....do.....	20,000 pounds of adulterated hay shipped from Nebraska to Georgia.	Decree of condemnation and destruction rendered; goods destroyed by order of court.
58c	.....	Utah.....	3 boxes of misbranded butter shipped from Wyoming to Utah.	Costs paid; goods released on $100 bond.

Cases terminated in favor of the United States 5

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THE TWENTY-EIGHT HOUR LAW.

ENFORCEMENT OF THE ACT.

During the fiscal year just passed the vigorous enforcement of the twenty-eight hour law (act of June 29, 1906; 34 Stat., 607) was consistently continued. The Department brought to the attention of the Attorney-General 438 apparent violations of the statute during that period. This is more than double the number of violations reported in the preceding fiscal year, only 208 cases being transmitted to the Department of Justice in that period. In the fiscal year 1908, however, 685 cases were reported for prosecution. There has been no slackening in the activity of the Department's inspectors, and the results shown would make it appear that the common carriers are not manifesting the same disposition to obey the act in the past fiscal year as in the fiscal year preceding. In fairness, however, it should be said that a large number of violations out of this total occurred in one district, so that the apparent disregard of the statute is not quite so general as would otherwise seem to be the case. Of the 438 cases reported, together with those coming over from the preceding fiscal year, 559 were pending at the close of the past fiscal year; penalties were assessed in 139 cases, and 29 cases were dismissed for insufficiency of evidence. In the preceding fiscal year, of the 208 cases reported during that period, together with those coming over from the preceding fiscal year, 305 cases were pending at the close of June 30, 1909; penalties were assessed in 617 cases, and 81 cases were dismissed because of the insufficiency of evidence. In the fiscal year 1909, 33 cases, or about 5 per cent, resulted adversely to the Government; in the fiscal year 1910, 19 cases were lost, or about 6 per cent of the total. In 1909, the penalties collected amounted to $73,490; costs paid $11,539.85. In 1910 penalties in the sum of $16,500 were recovered, and costs in the sum of $2,919.35 were paid.

If there has been any considerable improvement in the methods of handling stock in transit, it does not appear in the statistics of the enforcement of the twenty-eight hour law during the fiscal year 1910. More than twice as many instances of apparent violations of the statute were reported in 1910 as in the fiscal year preceding. It is true that the amount of the penalties collected in 1909 is far greater than in 1910, but this is due to the fact that more cases were reached for trial in 1909 than in 1910. The Government does not regard the twenty-eight hour law in the light of a revenue measure. Its purpose is, of course, to protect live stock in interstate transportation. Experience in the enforcement of the present act lends some support to the view that more adequate protection would be afforded live stock if a provision were incorporated in the act requiring carriers to maintain a reasonable minimum speed on all stock trains. It often happens, at the present time, that railroad companies comply rather with the letter of the statute than its spirit. By unloading live stock frequently they keep within the law, but great suffering is thereby inflicted on the animals, to say nothing of the additional expense to the shippers, all of which would be avoided if carriers were required to move live stock to destination with reasonable dispatch. The enactment of such a measure would round out the existing act and emphasize the desire of Congress that live stock in transit must be

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humanely handled. Of the need for such a provision of law there can be no doubt.

Nor could it be said that Congress would be very far in advance of the state legislatures in enacting such a measure. The act of March 19, 1903 (ch. 144, Laws of North Dakota, 1903, p. 195), provides, in effect, that common carriers engaged in the transportation of live stock shall maintain on all stock trains within the State an average minimum speed of not less than 20 miles per hour. The act of April 4, 1905 (ch. 5, Laws of Nebraska, p. 57), provides, in effect, that it shall be the duty of stock-yards companies to unload live stock within one and one-half hours from the time of arrival at the tracks connecting with the yards and the tender of the live stock to the company. Section 10606 (Stock shipments, rate of speed) of the act of March 29, 1909 (Laws of Nebraska, 1909, ch. 96, p. 403), provides, in effect, that common carriers shall transport live stock at a minimum speed of not less than 18 miles per hour. The supreme court of that State (in Crain *v.* Chicago, Burlington and Quincy R. R. Co., 122 N. W., 31) has declared this statute constitutional. The act of March 7, 1907 (ch. 276, Laws of Kansas, 1907, p. 448), provides, in effect, that common carriers shall transport live stock at a minimum speed of not less than 15 miles per hour. The act of April 10, 1907 (ch. 115, Laws of Iowa, 1907, p. 119), provides, in effect, that common carriers shall move cars of live stock at the highest speed consistent with reasonable safety, and that the board of railroad commissioners shall determine the speed at which live stock shall be moved. The act of May 17, 1907 (Laws of Illinois, 1907, p. 264), provides, in effect, that live stock shall not be confined by a common carrier in any car longer than thirty-six consecutive hours, at the expiration of which time they shall be fed and watered. A California statute (Laws of 1905, ch. 512) prescribes thirty-six hours as the maximum period of confinement of live stock by carriers without unloading for food, water, and rest. The period of rest must be at least ten consecutive hours. The act of 1905 (Laws of Florida, ch. 51) makes twenty-eight hours the maximum period of confinement of live stock by carriers, and also provides a maximum of three hours for detention in the cars at destination. A bill (H. R. 19041) was introduced in the House last session requiring carriers to maintain a minimum speed of not less than 16 miles per hour on all stock trains in interstate commerce. It was referred to committee, no further action being taken. This measure was prepared by me, at the request of persons interested in the protection of live stock in transit.

DECISIONS OF THE COURTS.

During the fiscal year 1910 the following important decisions were handed down in cases arising under the twenty-eight hour law:

UNITED STATES v SOUTHERN PACIFIC COMPANY.

[Circular No. 20, Office of the Solicitor; not reported in the Federal Reporter.]

It was charged in this case that the Southern Pacific Company had failed to comply with the provisions of the statute in that they unloaded stock into pens which were not properly equipped for feeding, resting, and watering live stock, as required by the act. In charging the jury Judge Bean stated that the purpose of the act was to prevent or reduce to a minimum the cruelty incident to the transportation of live stock. Stating

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that it was a question for the jury as to whether the pens were properly equipped, the court said that the statute did not define what was a properly equipped pen, but simply provided that they should be so arranged as to permit stock to be properly rested, fed, and watered therein. It was held no defense to say that the person in charge of the stock would not consent to their removal to such pens. The word "knowingly" as used in the act was held to mean "with knowledge of the facts," it being the duty of the company or its agents to use reasonable dilligence to know the facts; the word "willfully" was held to mean intentionally and voluntarily. Proof by a preponderance of the evidence was deemed sufficient. The jury was permitted to fix the amount of the penalty.

UNITED STATES v. ATLANTIC COAST LINE R. R. CO.

[173 Fed., 764; Circular No. 21, Office of the Solicitor.]

This case covered a shipment of calves, transported from Aulander, N. C., to Norfolk, Va. Owing to the failure of the conductor of the freight train to report the time during which they had been without feed, rest, and water on his train, the stock were confined in violation of the statute. It was claimed by the defendant company that they had issued instructions to their employees covering such shipments, which the conductor had failed to observe in this case. The circuit court of appeals for the fourth circuit held this no defense, reversing the lower court. A suit under the statute was held to be a civil proceeding. The words "knowingly and willfully," as used in the act, do not import an evil motive. Lack of foresight and due diligence on the part of agents of a carrier of live stock are imputable to the carrier, and it was expressly held that, in this case, the carrier knowingly and willfully violated the act. The assessment of the penalty was for the court.

SOUTHERN PACIFIC COMPANY v. UNITED STATES.

[171 Fed., 360; Circular No. 23, Office of the Solicitor.]

It was alleged in this case that the company had transported a consignment of sheep from Reno, Nev., to San Francisco, Cal., in violation of the act. Upon appeal from a decision in favor of the United States, the circuit court of appeals for the ninth circuit held that the statute was not unconstitutional, as delegating legislative power to the shipper, because he was authorized to extend the time of confinement of his stock from twenty-eight to thirty-six hours. The contention that the act was void for uncertainty in regard to its provisions for the confinement of sheep was overruled. It was also held that the shipment, not the train load, was the unit of violation.

SOUTHERN PACIFIC COMPANY v. UNITED STATES.

[171 Fed., 364; Circular No. 24, Office of the Solicitor.]

An unlawful confinement of sheep, loaded at Corinne, Utah, consigned to South San Francisco, Cal., was alleged in this case. It was contended that, while the defendant company owned the road over which the shipment was transported, to bring the prosecution in any other district than the one within which the violation took place was contrary to the sixth amendment to the Constitution. The circuit court of appeals for the ninth circuit held, however, in effect, that as a proceeding under the statute was a civil, not a criminal, action, the point was not well taken.

UNITED STATES v. ST. JOSEPH STOCK YARDS COMPANY.

[Circular No. 25, Office of the Solicitor; not reported in the Federal Reporter.]

This case involved four shipments of live stock from points in Nebraska to South St. Joseph, Mo. The defendant was a terminal company. The court held, in effect, that it was a railroad company within the meaning of the act; that the transportation from the points of origin to the stock yards at South St. Joseph, Mo., was a continuous shipment; that the purpose of the act is remedial and that the defendant, a connecting carrier, must learn at its peril how long live stock delivered to it had been previously confined without water, feed, and rest; that while in mitigation, it was no defense to say that the defendant acted promptly and quickly in transporting the live stock to the unloading pens.

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UNITED STATES v. STOCK YARDS TERMINAL COMPANY.

[178 Fed., 19; Circular No. 26, Office of the Solicitor; Circular No. 33, Office of the Solicitor.]

This case involved a shipment of live stock from Montana to Chicago, Ill., via St. Paul. The initial carrier had itself transported the live stock beyond the statutory limit without water, food, or rest at the time they were delivered to the defendant, which thereafter confined them for two hours and five minutes additional. Judgment was secured against the initial carrier. The lower court held that, as the Government had recovered from the initial carrier, the defendant was not suable in this case. On appeal to the circuit court of appeals for the eighth circuit the decision of the lower court was affirmed upon a different ground, namely, that the defendant had not knowingly and willfully violated the statute, applying the doctrine in St. Louis and San Francisco Railroad Company *v.* United States (169 Fed., 69; Circular No. 17, Office of the Solicitor).

UNITED STATES v. SOUTHERN PACIFIC CO.

[172 Fed., 909; Circular No. 28, Office of the Solicitor.]

The court held in this case that an action by the United States under the twenty-eight-hour law is a civil action, with all the ordinary incidents thereof, including the liability of the defeated party for costs. In such a case, in the district of Oregon, a docket or attorney's fee of $40 is taxable against the defendant, according to sections 824 and 837, Revised Statutes. It was held that the prevailing party was not entitled to tax, as part of the costs, the fees of the marshal for serving subpœnas on witnesses without the district and more than 100 miles from the place of trial; the mileage for witnesses of the prevailing party may be charged only from any point to which a subpœna would run, namely, from any point within the district and for not exceeding 100 miles from without the district. Under section 850, Revised Statutes, the United States is entitled, when the prevailing party, to tax as costs the necessary expenses of a salaried employee taken from his place of business to attend as a witness for the Government regardless of the distance traveled by him.

UNITED STATES v. NORTHERN PACIFIC TERMINAL CO.

[Circular No. 30, Office of the Solicitor; not reported in the Federal Reporter.]

In this case the defendant contended that being a terminal company it was not a carrier within the meaning of the act, and also that the defendant could not be held liable on a consignment when the Government had theretofore recovered from the initial carrier for confining the same shipment. Both these contentions were overruled. The court also held that the time consumed in switching cars of live stock from one track to another about the switching yards should not be deducted from the time of carriage.

BALTIMORE AND OHIO SOUTHWESTERN RAILWAY CO. v. UNITED STATES.

[Circular No. 31, Office of the Solicitor.]

On March 14, 1910, by an evenly divided bench, the Supreme Court of the United States affirmed the decision of the circuit court of appeals for the sixth circuit, holding that the shipment and not the train load is the unit of violation under the statute. (See Circulars Nos. 2 and 3; 159 Fed., 33, 38.) No opinion on the merits was delivered. On April 4, 1910, upon motion of the plaintiff in error, a rehearing was granted, and the case has been set for reargument during the month of October, 1910.

WABASH RAILROAD CO. v. UNITED STATES.

[178 Fed., 5; Circular No. 35, Office of the Solicitor.]

This case covered a shipment of cattle from Kansas City, Kans., to Elmo, Mo. A judgment was rendered against the Wabash Railroad Company for confining the cattle more than twenty-eight hours. A printed request for extension of the time to thirty-six hours accompanied the shipment. The lower court ruled out this request and disregarded it in entering the judgment. The circuit court of appeals for the eighth circuit reversed the decision of the trial court and held that a legal request for confinement

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of live stock may be made by the authorized agent of the owner of the particular shipment; that such a request may be printed, engraved, or stamped and partly in handwriting; a legal request may be made on or in a railroad form separate and apart from a printed bill of lading or other railroad form than one which contains the request alone; such a request may be made before the transportation of the shipment commences; and such a request may be made although it is not induced by any emergency or contingency that arises after the transportation commences and that was unforeseen at that time.

THE ATCHISON, TOPEKA AND SANTA FE RAILWAY CO. v. UNITED STATES.

[178 Fed., 12; Circular No. 36, Office of the Solicitor.]

This case involves an appeal by the plaintiff in error from a judgment in the lower court for five violations of the act. The circuit court of appeals for the eighth circuit affirmed the judgment of the lower court and held that a suit under the act is a civil action and a preponderance of the evidence in favor of the Government is sufficient to warrant a verdict against the defendant. It is the duty of the court to fix the penalty. The question as to what constitutes a legal request for extension of time to thirty-six hours was also decided in this case the same as in the one reported in Circular No. 35, Office of the Solicitor.

THE MISSOURI, KANSAS AND TEXAS RAILWAY CO. v. UNITED STATES.

[178 Fed., 16; Circular No. 37, Office of the Solicitor.]

The questions presented in this case were the same as in the case reported in Circular No. 36, Office of the Solicitor. The circuit court of appeals for the eighth circuit held, in addition to the questions above referred to, that under the twenty-eight hour law, whether an extension request complies with the statute is a question of law for the court; it is error to submit such question to the jury.

The most noteworthy case before the courts during the past year was Baltimore and Ohio Southwestern Railroad Company *v.* United States. It is the first case, under the present statute, to reach the Supreme Court, the issue being narrowed to a single important point—the unit of violation as contemplated by the act. It is the practice of railroad companies to transport many different consignments of live stock in the same train load; should the Supreme Court decide, as the Government contends, that the consignment is the unit of violation, the penalties for the detention of live stock will be proportionately larger than if that court should hold the train load to be the unit. It would seem probable that the Government will secure a favorable ruling in the case, since the district court and the court of appeals both ruled in its favor when the case was before them.

United States *v.* National Stock Yards Company, involving the liability of a terminal company, in general, under the act, is also before the Supreme Court, and will probably be reached about the same time that the Baltimore and Ohio Southwestern Railroad Company *v.* United States is reargued. It involves the liability of a stockyards company under the statute. The district and circuit courts both decided against the Government in this case, though the same question has been twice resolved in favor of the Government in other jurisdictions (United States *v.* St. Joseph Stock Yards Co., Circular No. 25; United States *v.* Northern Pacific Terminal Co., Circular No. 30); these decisions hold flatly that such companies are liable under the act. Where companies similarly organized have been held not amenable to the act, the decision was based on the view that they were not shown to have knowingly and wilfully violated its terms, as provided in section 3 (United States *v.* Sioux City Stock Yards Co., 162 Fed., 556; same, 167 Fed., 126; United States *v.* Terminal Stock Yards Co., 178 Fed., 19). While these cases may have disposed of

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the issues involved, they establish no precedent as to the liability of stock yards or terminal companies in general. Indeed, Judge Reed, in the Sioux City Stock Yards case, held that the defendant was amenable, in general, to the act.

A novel situation is presented in the Stock Yards Terminal case. The Government had recovered from the initial carrier, and sought to recover also from the connecting carrier, by which the same shipment of live stock was further transported in violation of the act. The lower court decided that the terminal company had not violated the law, thus holding that the time during which the stock had been confined by the preceding carrier could not be counted against the defendant. This decision disregards the plain provisions of the act. No explanation is given as to the ground on which the decision is based. The court did not even recognize the right of the Government to sue either carrier, at its election, but held, in effect, that the defendant had not violated the law because it did not confine the stock on its own line over twenty-eight hours. It should be noted that the circuit court of appeals for the eighth circuit, while affirming the court below, sought other ground of decision. There is now pending, before the same appellate court, United States *v.* Wabash Railroad Co., which involves the converse of the proposition in the Stock Yards Terminal case. In that case the Government recovered, first, from the terminal company for a confinement of stock on its own line, of less than twenty-eight hours, the initial and connecting carrier having theretofore confined the same shipment in excess of the statutory period. After recovering from the terminal company, proceedings were instituted against the initial carrier; under these circumstances the lower court held that the Government could not recover. Obviously, the torment of hunger, thirst, and weariness increases after the statutory period expires; consequently, Congress must have intended in this statute to prohibit carriers from accepting stock for further transportation, when they had been already confined in violation of the act, extending to live stock the humane protection demanded by their nature and the conditions of transit by rail. The decision of the lower court in the Stock Yards Terminal case seems to proceed on the theory that live stock in the course of continuous transportation require feed, water, and rest only at the end of twenty-eight hour periods, but, if not fed, watered, and rested at the expiration of that time, they suffer no increasing detriment until another twenty-eight hours has expired.

In United States *v.* Stockyards Terminal Railroad Company (178 Fed., 19; Circular No. 33, Office of the Solicitor) the circuit court of appeals for the eighth circuit applied the construction of the expression "knowingly and willfully," as laid down in St. Louis and San Francisco Railroad Co. *v.* United States (169 Fed., 69, 71; Circular No. 17, Office of the Solicitor). The court said, in effect, that the defendant not having actual knowledge of how long the live stock had been without water, feed, and rest when it accepted them, did not knowingly and willfully violate the act. It is regrettable that the court did not deem it necessary to discuss, in this connection, the duty of connecting carriers; as the decision now stands, it might be held to support the view that of connecting carriers none violate the law except those having actual knowledge of the period of previous confinement. It was stipulated that it was the duty of railroad agents to mark the billing, so as to show connecting carriers when

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and where the shipment had feed, rest, and water. This was not done in this case. It might well be contended, therefore, that the terminal company acted at its peril if it transported this consignment farther where the billing failed to give any information as to watering, feeding, and resting. In United States *v.* St. Joseph Stock Yards Co. (Circular No. 25, Office of the Solicitor) the court expressly and emphatically holds that there is a duty resting on connecting carriers to inquire as to previous confinement. In Pierson *v.* Northern Pacific Ry. Co. (100 Pac., 999, 1001), the supreme court of Washington said:

> The federal statute covers this question. It provides that in estimating the time during which the animals have been confined without rest on connecting roads shall be included; thus making it the duty of the connecting carrier to inquire concerning such time when the animals are received by it, if the fact does not appear on the way-bills submitted to it.

If the statute imposes a duty upon common carriers of live stock, and if such carriers are chargeable with knowledge, not merely of what they actually knew, but as well with knowledge of facts which they might have ascertained upon reasonable inquiry (in accord, United States *v.* Fort Worth Belt Ry. Co., Circular No. 11, Office of the Solicitor; United States *v.* Colorado and Southern Ry. Co.; Circular No. 7, Office of the Solicitor), how could it be decided that the defendant, in the Stock Yards Terminal case, did not knowingly and willfully violate the law when it appeared simply that the company did not have actual knowledge of how long the live stock had been previously confined?

A group of three important cases, involving practically the same issues, was also decided by the circuit court of appeals for the eighth circuit at the close of the past fiscal year (Wabash R. R. Co. *v.* United States, 178 Fed., 5; Circular No. 35, Office of the Solicitor; Atchison, Topeka and Santa Fe R. R. Co. *v.* United States, 178 Fed., 12; Circular No. 36, Office of the Solicitor; Missouri, Kansas and Texas R. R. Co. *v.* United States, 178 Fed., 16; Circular No. 37, Office of the Solicitor). The most important points in all these cases were as to whether an extension request, provided for in section 1 of the act, might be made on a railroad form, though separate from the bill of lading or other railroad form, and whether such a request might be made before the shipment started. The circuit court of appeals held that Congress intended simply to prevent the extension request from being concealed in some railroad form, used for another purpose, and thus withdraw the attention of the signer from it. This was in accordance with the ruling of this Office, as stated in the opinion. It was held by the court that such requests might be made out by shippers or their agents, on forms supplied by the railroad companies, provided these complied with the other requirements of the act. It was also held that such a request might be made out before the shipment started. Counsel for the Government contended that the requests must be induced by an unforeseen contingency arising during the transportation. The court held, however, that extension of time beyond twenty-eight hours was permitted without a request, upon an unforeseen cause of delay, and the granting of a request only upon the happening of an unforeseen cause of delay would have created a double exception to the law, which is repugnant.

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Summary of suits under the twenty-eight hour law resulting in judgment for the Government during the fiscal year from July 1, 1909, to June 30, 1910.

Case No.	Railroad involved.	Judicial district.	Penalty assessed.	Costs assessed.
1622	Atchison, Topeka and Santa Fe	Texas, northern district	$100	$32.08
1772	do	Kansas	100	34.40
1773	do	do	100	31.50
1774	do	do	100	35.90
1775	do	do	100	36.40
1776	do	do	100	78.10
1796	do	Missouri, western district	100	19.77
1800	do	Kansas	100	31.30
1801	do	do	100	36.10
1802	do	do	100	35.90
1803	do	do	100	46.95
1817	do	Texas, northern district	100	25.30
1836	do	Kansas	100	18.85
1844	do	do	100	18.15
1863	do	do	100	18.05
1864	do	do	100	18.05
1871	do	do	100	18.05
1872	do	do	100	18.05
1873	do	do	100	18.05
1874	do	do	100	18.05
1887	do	do	100	18.05
1888	do	do	100	18.05
1900	do	do	100	18.05
1901	do	do	100	18.05
1909	do	do	100	17.45
1913	do	do	100	17.45
1924	do	do	100	17.45
1925	do	do	100	17.45
1929	do	do	100	17.60
1937	do	do	100	17.70
1938	do	do	100	17.60
1939	do	do	100	17.60
1682	Chicago and Alton	Illinois, northern district	100	12.85
1941	do	do	100	13.70
1744	Chicago and Northwestern	do	100	.....
1838	do	do	100	.....
1839	do	do	100	.....
1840	do	do	100	.....
1846	do	do	100	.....
1847	do	do	100	.....
1954	do	do	100	.....
1955	do	do	100	.....
1956	do	do	100	.....
1980	do	do	100	.....
1981	do	do	100	.....
1982	do	do	100	.....
1766	Chicago, Burlington and Quincy	Illinois, eastern district	100	16.90
2007	do	Illinois, northern district	100	13.60
2008	do	do	100	13.60
1768	Chicago, Milwaukee and St. Paul	do	100	.50
1807	do	do	100	.50
1862	do	do	100	15.00
1957	do	do	100	.65
1959	do	do	100	15.15
1690	Chicago, Rock Island and Gulf	Texas, northern district	100	26.25
1815	do	do	100	25.30
1783	Chicago, Rock Island and Pacific	Kansas	100	18.70
1810	do	Illinois, southern district	100	16.80
1854	do	Kansas	100	18.85
1855	do	do	100	18.75
1885	do	Iowa, southern district	100	12.00
1897	do	Kansas	100	19.30
2002	do	Colorado	200	21.92
2003				
1878	Denver and Rio Grande	do	100	
1880	do	do	100	
1882	do	do	100	
1883	do	do	100	31.92
1884	do	do	100	
1886	do	do	100	
1799	Illinois Central	Illinois, northern district	100	15.15
1814	do	do	100	13.85
1818	do	do	100	15.15
1819	do	do	100	15.00
1820	do	do	100	15.15
1904	do	do	100	14.00
1905	do	do	100	14.00
1978	do	do	100	15.00
1979	do	do	100	15.15

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Summary of suits under the twenty-eight hour law resulting in judgment for the Government during the fiscal year from July 1, 1909, to June 30, 1910—Continued.

Case No.	Railroad involved.	Judicial district.	Penalty assessed.	Costs assessed.
1852	Iowa Central	Minnesota	$100	$21.07
1763	Kansas City, Clinton and Springfield	Missouri, western district	100	19.85
1892	Kansas City Southern	Kansas	100	21.36
1831	Lake Shore and Michigan Southern	Illinois, northern district	100	14.00
1833	do	do	100	13.85
1813	Missouri Pacific	Missouri, western district	100	18.75
1876	do	do	100	19.75
1879	do	do	100	19.50
1881	do	do	100	19.50
1899	Northern Pacific	Washington, western district	100	25.02
1949	do	Minnesota	250	19.82
1782	Oregon Railroad and Navigation Co.	Oregon	100	35.32
1848	do	do	100	34.82
2001	Pecos and Northern Texas	Texas, northern district	100	25.40
1599	Pennsylvania	Pennsylvania, western district	200	17.85
1906	Pere Marquette	Illinois, northern district	100	13.60
1269	St. Louis and San Francisco	Missouri, western district	100	43.66
1428	do	do	100	27.65
1763	do	do	100	31.44
1777	do	Kansas	100	18.60
1778	do	do	100	18.60
1821	do	do	100	18.60
1822	do	do	100	18.75
1859	do	Missouri, eastern district	100	18.78
1870	do	do	100	20.90
1877	do	do	100	
1915	do	Missouri, western district	100	11.58
1917	do	Missouri, eastern district	200	23.58
1918				
1968	do	do	100	19.06
1858	St. Louis Merchants Bridge Terminal	Illinois, eastern district	100	16.00
1920	do	do	100	16.00
403	Southern Pacific	Nevada	300	
576	do	California, northern district	300	13.40
728	do	do	400	15.20
772	do	do	100	13.40
774	do	do	100	15.00
828	do	do	100	15.40
936	do	do	100	13.60
994	do	do	300	13.60
995	do	do	200	15.40
1059	do	do	100	15.40
1060	do	do	100	13.60
1077	do	Oregon	200	39.50
1078	do	do	200	39.62
1086	do	do	200	39.50
1472	do	Nevada	200	
1804	do	California, southern district	250	386.94
1823	Spokane, Portland and Seattle	Oregon	250	33.12
1766	Terminal Railroad Association of St. Louis.	Illinois, eastern district	100	16.00
1868	do	do	100	16.00
1875	do	do	100	
1902	do	do	100	16.06
411	Union Pacific	Wyoming	250	56.42
412	do	do	250	56.42
413	do	do	250	56.42
414	do	do	250	56.42
415				
416	do	do	250	56.42
1977	Wabash	Illinois, northern district	100	17.71

139 cases; penalties recovered, $16,500; costs, $2,919.35.

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LIVE STOCK QUARANTINE ACTS.

One hundred and forty alleged violations by persons and railroad companies, of the act of March 3, 1905, "An act to enable the Secretary of Agriculture to establish and maintain quarantine districts, to permit and regulate the movement of cattle and other live stock therefrom, and for other purposes" (33 Stat., 1264), were reported to the Attorney-General during the fiscal year ended June 30, 1910. Eight alleged violations of the act of May 29, 1884, "An act for the establishment of the Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals" (23 Stat., 31), were reported to the Attorney-General during the same year.

At the beginning of the fiscal year ended June 30, 1910, 125 cases involving violations of the act of March 3, 1905, and 7 cases involving violations of the act of May 29, 1884, reported during previous fiscal years, remained unsettled.

In 20 cases under the act of March 3, 1905, fines aggregating the sum of $2,600, and in 4 cases under the act of May 29, 1884, fines amounting to $370, were imposed, upon pleas of guilty, during the fiscal year, exclusive of costs in each case. In one case, under the former act, the two defendants were committed to jail in default of payment of the fine.

Five cases under the act of March 3, 1905, were dismissed; in 4 cases the grand jury failed to return indictments; and in 1 case sentence was suspended.

In a case under the act of March 3, 1905, against the Louisville and Nashville Railroad Company, in which the defendant company failed to comply with the regulations made and promulgated under the act requiring the placarding of cars and annotating of waybills, decided March 15, 1910, in the district court for the northern district of Alabama (176 Fed. Rep., 942; Circular No. 34, Office of the Solicitor), a demurrer had been interposed by the defendant attacking the constitutionality of the act upon the ground that its effect is to delegate legislative authority to the executive, and because no complete offense is defined by the terms of the statute. It was held that the act was not invalid as, in effect, attempting to create an offense for violation of the Department rule, and that the statute, in and of itself, completely creates the offense, the effect of the provisions authorizing the Secretary of Agriculture to permit shipments when the public safety permits, under certain conditions, constituting merely a suspensory power in specific instances, conditioned upon the observance of certain safeguards to be prescribed by the rules of the Department. Similar demurrers interposed by the same defendant in three other cases brought in as many districts are now pending.

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The following table shows the cases under the act of May 29, 1884, and the act of March 3, 1905, reported, finally determined, or pending at the close of the fiscal year ended June 30, 1910:

Violations of the act of May 29, 1884, reported to the Department of Justice, pending or disposed of during the fiscal year ended June 30, 1910.

Case No.	Defendant.	Judicial district.	Offense charged.	Status.
36	H. J. Benson	Iowa, northern district.	Shipment of sheep affected with scabies.	Defendant indicted; pending.
39	J. S. Cusick, R. C. Richards, and Owen Roberts.	Wisconsin, western district.	Shipment in nine consignments of 1,229 sheep affected with scabies.	Richards indicted and fines of $100 and costs imposed; dismissed as to Cusick and Roberts.
43	H. J. Benson	Iowa, northern district.	Shipment of sheep affected with scabies.	Defendant indicted; pending.
55	H. H. Brownell	Nebraska	Shipment of cattle affected with scabies.	Plea of guilty entered; fine of $100 and costs imposed.
68	W. H. Whaley, jr.	Kentucky, eastern district.	Shipment of sheep affected with scabies.	Capias issued; pending.
138	Louis Gray	Missouri, eastern district.	do	Suit filed; pending.
148	William Harting	Iowa, northern district.	Shipment of one cow affected with tuberculosis.	Plea of guilty entered; fine of $150 and costs imposed.
191	W. H. Whaley, jr.	Kentucky, eastern district.	Shipment of sheep affected with scabies.	Capias issued; pending.
210	S. K. Hodgkin	do	do	Do.
215	J. Jenson, and Allen Dudley.	Nebraska	Driving one cow interstate, affected with tuberculosis.	Defendants indicted for conspiracy to violate the act; pleas of guilty entered and fine of $10 imposed on each defendant.

Violations of the act of March 3, 1905, reported to the Department of Justice, pending or disposed of during the fiscal year ended June 30, 1910.

Case No.	Defendant.	Judicial district.	Offense charged.	Status.
536a	Terminal Railroad Association of St. Louis.	Texas, northern district.	Transportation of sheep from area quarantined for scabies, to another State.	Suit filed; pending.
544a	St. Louis and San Francisco R. R.	Illinois, eastern district.	Transportation of cattle from area quarantined for splenetic fever, to another State.	Plea of guilty entered; fine of $200 and costs imposed.
546a	do	do	do	Plea of guilty entered; fine of $100 and costs imposed.
547a	do	do	do	Plea of guilty entered; fine of $200 and costs imposed.
548a	do	do	do	Do.
565a	Chicago, Burlington and Quincy R. R.	Missouri, western district.	do	Defendant indicted; pending.
565a	do	do	do	Dismissed.
567a	do	do	do	Do.
579a	Louisville and Nashville R. R.	Illinois, eastern district.	do	Defendant indicted; demurrer to constitutionality of act interposed by defendant; pending.
597a	Atchison, Topeka and Santa Fe Ry.	Missouri, western district.	do	Defendant indicted; pending.
601a	Cincinnati, New Orleans and Texas Pacific Ry.	Ohio, southern district.	do	Plea of guilty entered; fine of $100 and costs imposed.

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Violations of the act of March 3, 1905, reported to the Department of Justice, pending or disposed of during the fiscal year ended June 30, 1910—Continued.

Case No.	Defendant.	Judicial district.	Offense charged.	Status.
602a	Louisville and Nashville R. R.	Alabama, northern district.	Transportation of cattle from area quarantined for splenetic fever, to another State.	Defendant indicted; demurrer interposed by defendant to constitutionality of act overruled; pending.
603a	St. Louis Merchants Bridge Terminal Railway.	Illinois, eastern district.	.....do.....	Suit filed; pending.
606a	Chicago, Burlington and Quincy R. R.	.....do.....	Transportation of cattle from area quarantined for scabies, to another State.	Do.
607a	.....do.....	.....do.....	.....do.....	Do.
618a	El Paso and Southwestern Ry.	Texas, western district.	.....do.....	Defendant indicted; demurrer interposed by defendant sustained.
619a	Louisville and Nashville R. R.	Tennessee, middle district.	Transportation of cattle from area quarantined for splenetic fever, to another State.	Defendant indicted; demurrer interposed by defendant to constitutionality of act; pending.
621a	St. Louis and San Francisco R. R.	Missouri, western district.	.....do.....	Defendant indicted; dismissed because of successful suit under twenty-eight hour law, arising out of same transaction.
623a	Louisville and Nashville R. R.	Tennessee, middle district.	.....do.....	Defendant indicted; demurrer interposed by defendant to constitutionality of act; pending.
624a	.....do.....	Alabama, northern district.	.....do.....	Defendant indicted; pending.
637a	Chicago, Rock Island and Pacific Ry.	Oklahoma, eastern district.	.....do.....	Do.
640a	Atchison, Topeka and Santa Fe Ry.	Oklahoma, western district.	.....do.....	Do.
641a	St. Louis Merchants Bridge Terminal Railway.	Illinois, eastern district.	.....do.....	Suit filed; pending.
642a	Terminal Railroad Association of St. Louis.	.....do.....	.....do.....	Do.
41	John F. Ravencroft. and John A. Edwards.	Oklahoma, western district.	Driving cattle from area quarantined for splenetic fever, to another State.	Grand jury failed to indict.
45	James Marler, and J. H. Ballantyne.	Idaho.....	Driving sheep from area quarantined for scabies, to another State.	Defendants indicted; pending.
46	John Zane and Elmer Edwards.	Oklahoma, eastern district.	Driving one cow from area quarantined for splenetic fever, to another State.	Zane indicted; warrant issued; pending.
47	L. D. Hoy.....	Oregon.....	Driving sheep from area quarantined for scabies, to another State.	Plea of guilty entered; fine of $100 and costs imposed.
48	E. A. Maxwell, and S. C. Davis.	Arkansas, eastern district.	Driving cattle from area quarantined for splenetic fever, to another State.	Pleas of guilty entered; fine of $100 and costs imposed on each defendant, in default of which they were committed to jail.
50	R. L. McCary and A. J. James.	Texas, northern district.	Driving sheep from area quarantined for scabies, to another State.	Grand jury failed to indict.
59	T. K. Obray.....	Utah.....	Driving 5,600 sheep from area quarantined for scabies, to another State.	Plea of guilty entered; fine of $100 and costs imposed.
61	J. B. Hampton.....	South Carolina.....	Shipment of one cow from area quarantined for splenetic fever, to another State.	Dismissed.

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Violations of the act of March 3, 1905, reported to the Department of Justice, pending or disposed of during the fiscal year ended June 30, 1910—Continued.

Case No.	Defendant.	Judicial district.	Offense charged.	Status.
62	Rossell Sammons....	Pennsylvania, western district.	Driving sheep from area quarantined for foot-and-mouth disease, to another State.	Grand jury failed to indict.
63	Erie Railroad.....	New York, western district.	Transportation of cattle from area quarantined for foot-and-mouth disease, to another State.	Defendant indicted; nolle prossed.
64	Charles McElwain...	.....do.....	Shipment of cattle from area quarantined for foot-and-mouth disease, to another State.	Plea of guilty entered; sentence suspended.
65	Erie Railroad and Charles McElwain.	.....do.....	Transportation and delivery for shipment of cattle from area quarantined for foot-and-mouth disease, to another State.	Defendants indicted; nolle prossed.
67	St. Louis and San Francisco R. R. and L. A. Jinkins.	Oklahoma, western district.	Transportation and delivery for shipment of cattle from area quarantined for splenetic fever, to another State.	Grand jury failed to indict.
75	Terminal Railroad Association of St. Louis.	Illinois, eastern district.	Transportation of cattle from area quarantined for scabies, to another State.	Suit filed; pending.
76	St. Louis Merchants Bridge Terminal Railway.	.....do.....	.....do.....	Do.
78	J. A. Carter.....	Arkansas, eastern district.	Driving cattle from area quarantined for splenetic fever, to another State.	Plea of guilty entered; fine of $100 and costs imposed.
79	J. A. Beggs.....	.....do.....	.....do.....	Do.
82	E. P. Johnson and W. W. Luna.	Missouri, western district.	.....do.....	Pleas of guilty entered; fine of $100 and costs imposed on each defendant.
85	Gulf, Colorado and Santa Fe Ry.	Texas, eastern district.	Transportation of cattle from area quarantined for splenetic fever, to another State.	Defendant indicted; pending.
86	.....do.....	.....do.....	.....do.....	Do.
87	St. Louis Merchants Bridge Terminal Railway.	Missouri, eastern district.	Transportation of cattle from area quarantined for scabies, to another State.	Verdict of guilty; fine of $200 and costs imposed; writ of error issued to circuit court of appeals; decision not yet rendered.
88	.....do.....	.....do.....	Transportation of sheep from area quarantined for scabies, to another State.	Do.
89	.....do.....	.....do.....	.....do.....	Do.
91	Seaboard Air Line Ry.	South Carolina.....	Transportation of cattle from area quarantined for splenetic fever, to another State.	Suit filed against receivers of railroad company; plea of guilty entered, and fine of $100 and costs imposed.
92	.....do.....	.....do.....	.....do.....	Do.
93	St. Louis Merchants Bridge Terminal Railway.	Missouri, eastern district.	Transportation of cattle from area quarantined for scabies, to another State.	Verdict of guilty; fine of $200 and costs imposed; writ of error issued to circuit court of appeals; decision not yet rendered.
94	.....do.....	.....do.....	Transportation of sheep from area quarantined for scabies, to another State.	Do.
96	Terminal Railroad Association of St. Louis.	Illinois, eastern district.	Transportation of cattle from area quarantined for scabies, to another State.	Suit filed; pending.
97	.....do.....	.....do.....	.....do.....	Do.
100	.....do.....	.....do.....	Transportation of sheep from area quarantined for scabies, to another State.	Do.
101	.....do.....	.....do.....	Transportation of cattle from area quarantined for scabies, to another State.	Do.
102	St. Louis Merchants Bridge Terminal Railway.	.....do.....	.....do.....	Do.
104	R. C. McManus.....	North Carolina, western district.	Shipment of cattle from area quarantined for splenetic fever, to another State.	Defendant indicted; pending.

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Violations of the act of March 3, 1905; reported to the Department of Justice, pending or disposed of during the fiscal year ended June 30, 1910—Continued.

Case No.	Defendant.	Judicial district.	Offense charged.	Status.
106	St. Louis Merchants Bridge Terminal Railway.	Illinois, eastern district.	Transportation of cattle from area quarantined for scabies, to another State.	Suit filed; pending.
106	.....do.....	.....do.....	Transportation of sheep from area quarantined for scabies, to another State.	Do.
107	.....do.....	.....do.....	.....do.....	Do.
108	Terminal Railroad Association of St. Louis.	.....do.....	Transportation of cattle from area quarantined for scabies, to another State.	Do.
109	.....do.....	.....do.....	.....do.....	Do.
110	St. Louis Merchants Bridge Terminal Railway.	.....do.....	.....do.....	Do.
111	Cincinnati, New Orleans and Texas Pacific Ry.	Ohio, southern district.	Transportation of cattle from area quarantined for splenetic fever to another State.	Plea of guilty entered; fine of $100 and costs imposed.
112	S. A. Crane, William Walkup, and John Craig.	North Carolina, western district.	Driving cattle from area quarantined for splenetic fever to another State.	Defendants indicted; pending.
115	Terminal Railroad Association of St. Louis.	Illinois, eastern district.	Transportation of cattle from area quarantined for splenetic fever to another State.	Suit filed; pending.
116	.....do.....	.....do.....	Transportation of sheep from area quarantined for scabies to another State.	Do.
118	.....do.....	.....do.....	Transportation of cattle from area quarantined for splenetic fever to another State.	Do.
119	.....do.....	.....do.....	.....do.....	Do.
120	.....do.....	.....do.....	.....do.....	Do.
121	.....do.....	.....do.....	.....do.....	Do.
122	.....do.....	.....do.....	.....do.....	Do.
123	St. Louis Merchants Bridge Terminal Ry.	.....do.....	Transportation of sheep from area quarantined for scabies to another State.	Do.
124	.....do.....	.....do.....	.....do.....	Do.
125	.....do.....	.....do.....	.....do.....	Do.
126	.....do.....	.....do.....	.....do.....	Do.
127	.....do.....	.....do.....	.....do.....	Do.
128	.....do.....	.....do.....	.....do.....	Do.
129	.....do.....	.....do.....	.....do.....	Do.
130	.....do.....	.....do.....	.....do.....	Do.
131	.....do.....	.....do.....	.....do.....	Do.
132	.....do.....	.....do.....	Transportation of cattle from area quarantined for scabies to another State.	Do.
133	Terminal Railroad Association of St. Louis.	.....do.....	Transportation of cattle from area quarantined for splenetic fever to another State.	Do.
135	Atchison, Topeka and Santa Fe Ry.	Missouri, western district.	.....do.....	Defendant indicted; pending.
139	Baltimore and Ohio Southwestern R. R.	Ohio, southern district.	Transportation of sheep from area quarantined for scabies to another State.	Demurrer to information interposed by defendant sustained on ground that prosecution does not lie against a carrier outside of the quarantined area.
140	.....do.....	.....do.....	.....do.....	Do.
141	.....do.....	.....do.....	.....do.....	Do.
142	.....do.....	.....do.....	.....do.....	Do.
143	.....do.....	.....do.....	.....do.....	Do.
144	.....do.....	.....do.....	.....do.....	Do.
145	.....do.....	.....do.....	.....do.....	Do.
146	.....do.....	.....do.....	.....do.....	Do.
147	.....do.....	.....do.....	.....do.....	Do.
151	St. Louis Merchants Bridge Terminal Ry.	Illinois, eastern district.	Transportation of cattle from area quarantined for scabies to another State.	Suit filed; pending.
152	.....do.....	.....do.....	.....do.....	Do.
153	.....do.....	.....do.....	.....do.....	Do.
154	.....do.....	.....do.....	.....do.....	Do.
155	.....do.....	.....do.....	.....do.....	Do.
156	.....do.....	.....do.....	.....do.....	Do.
157	A. W. Whitaker....	North Carolina, western district.	Shipment of cattle from area quarantined for splenetic fever to another State.	Defendant indicted; pending.

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Violations of the act of March 3, 1905, reported to the Department of Justice, pending or disposed of during the fiscal year ended June 30, 1910—Continued.

Case No.	Defendant.	Judicial district.	Offense charged.	Status.
159	Baltimore and Ohio Southwestern R. R.	Ohio, southern district.	Transportation of sheep from area quarantined for scabies to another State.	Demurrer to information interposed by defendant sustained on ground that prosecution does not lie against a carrier outside of the quarantined area.
160	....do....	....do....	....do....	Do.
161	....do....	....do....	....do....	Do
162	....do....	....do....	....do....	Do.
163	....do....	....do....	....do....	Do.
164	....do....	....do....	....do....	Do.
167	Illinois Central R. R.	Illinois, eastern district.	....do....	Plea of guilty entered; fine of $100 and costs imposed.
170	Atchison, Topeka and Santa Fe Ry.	Oklahoma, eastern district.	Transportation of cattle from area quarantined for splenetic fever to another State.	Do.
171	Baltimore and Ohio Southwestern R. R.	Ohio, southern district.	Transportation of sheep from area quarantined for scabies to another State.	Demurrer to information interposed by defendant sustained on ground that prosecution does not lie against a carrier outside of the quarantined area.
172	....do....	....do....	....do....	Do.
173	....do....	....do....	....do....	Do.
174	P. M. Brown, J. D. Patterson, and A. H. Pack.	Georgia, northern district.	Driving cattle from area quarantined for splenetic fever to another State.	Defendants indicted; pending.
175	W. W. Anderson...	North Carolina, western district.	....do....	Plea of guilty entered; fine of $100 and costs imposed.
178	St. Louis and San Francisco R. R., and Chicago, Rock Island and Pacific Ry.	Oklahoma, eastern district.	Transportation of cattle from area quarantined for splenetic fever to another State.	Pleas of guilty entered; fine of $100 and costs imposed on each defendant.
179	St. Louis Merchants Bridge Terminal Ry.	Illinois, eastern district.	Transportation of cattle from area quarantined for scabies to another State.	Suit filed; pending.
180	Terminal Railroad Association of St. Louis.	....do....	Transportation of cattle from area quarantined for splenetic fever to another State.	Do.
181	....do....	....do....	....do....	Do.
183	Baltimore and Ohio Southwestern R. R.	Ohio, southern district.	Transportation of sheep from area quarantined for scabies to another State.	Demurrer to information interposed by defendant sustained on ground that prosecution does not lie against a carrier outside of the quarantined area.
184	....do....	....do....	....do....	Do.
185	....do....	....do....	....do....	Do.
186	....do....	....do....	....do....	Do.
189	Seaboard Air Line Ry.	South Carolina.....	Transportation of cattle from area quarantined for splenetic fever to another State.	Defendant indicted; pending.
193	Chicago, Rock Island and Pacific Ry.	Arkansas, eastern district.	....do....	Plea of guilty entered; fine of $100 and costs imposed.
196	John Ealinger, H. E. Whaley, and P. H. Whaley.	Tennessee, eastern district.	Driving cattle from area quarantined for splenetic fever to another State.	Grand jury failed to indict.
198	Baltimore and Ohio Southwestern Ry.	Ohio, southern district.	Transportation of sheep from area quarantined for scabies to another State.	Demurrer to information interposed by defendant sustained on ground that prosecution does not lie against a carrier outside of the quarantined area.

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Violations of the act of March 3, 1905, reported to the Department of Justice, pending or disposed of during the fiscal year ended June 30, 1910—Continued.

Case No.	Defendant.	Judicial district.	Offense charged.	Status.
199	Atchison, Topeka and Santa Fe Ry.	Oklahoma, western district.	Transportation of cattle from area quarantined for splenetic fever to another State.	Defendant indicted; pending.
200	Kansa City, Mexico and Orient Ry.	Kansas	do	Suit filed; pending.
201	do	do	do	Do.
202	do	do	do	Do.
203	P. Markey, B. E. Hughes, and Missouri Pacific Ry.	do	Transportation and delivery for shipment of cattle from area quarantined for scabies to another State.	Do.
209	T. J. Brown	Missouri, western district.	Driving cattle from area quarantined for splenetic fever to another State.	Plea of guilty entered; fine of $100 and costs imposed.
214	George W. Caldwell.	Arkansas, eastern district.	do	Defendant left jurisdiction; proceedings for his removal pending.
224	Southern Railway	South Carolina	Transportation of cattle from area quarantined for splenetic fever to another State.	Defendant indicted; pending.
228	do	do	do	Do.
229	do	do	do	Do.
231	do	do	do	Do.
232	do	do	do	Do.
251	Chicago, Rock Island and Pacific Ry.	Oklahoma, western district.	do	Do.

By far the greater number of prosecutions under the act of March 3, 1905, are brought against railroad companies, as may be seen by reference to the accompanying table, and most of these cases involve the failure of the railroads to comply with the regulation made and promulgated under the act permitting the interstate transportation of cattle and sheep from quarantined areas to recognized slaughtering centers for immediate slaughter, but requiring that placards of a prescribed size and description shall be placed and maintained during transit on the cars containing such shipments, and that the waybills and other shipping memoranda pertaining to such shipments shall be annotated in a prescribed manner. Such shipments in many instances are transported over one or more railroads besides the initial carrier before they reach their destination, such connecting carriers usually lying wholly without the State or district quarantined. The cars and waybills in such cases, when inspected by inspectors of the Bureau of Animal Industry at these slaughtering centers, are usually in the hands of railroad companies doing a terminal business. In this class belong a number of cases recently prosecuted in the southern district of Ohio and the eastern district of Missouri.

In the southern district of Ohio proceedings were instituted in three cases under the act of March 3, 1905, against the Baltimore and Ohio Southwestern Railroad, in receiving in the State of Ohio, from connecting railroads, and transporting shipments of sheep originating in the State of Kentucky, which is quarantined for scabies in sheep. A demurrer interposed by the defendant corporation was sustained by the court solely on the ground that the shipments in question were received by the defendant railroad at a point outside of the quarantined State or district. The Government was unable to secure

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a review of this decision under the criminal appeals act of March 2, 1907 (34 Stat., 1246), inasmuch as the provisions of that act apply only to proceedings by indictment, and prosecution in the cases in question was by information. The United States attorney, however, has been instructed to bring another case by indictment, and in the event of a decision adverse to the Government, to sue out a writ of error, and, if possible, secure a reversal of such holding of the district court.

In a case brought in the eastern district of Missouri, against the St. Louis Merchants Bridge Terminal Railway, embracing five violations of the act of March 3, 1905 (referred to in the foregoing table as Nos. 87, 88, 89, 93, and 94), a verdict of guilty was returned in each count, and fines aggregating $1,000 and costs were imposed. After an unsuccessful motion in arrest of judgment, a writ of error issued to the defendant corporation, and the cause was argued before the United States circuit court of appeals for the eighth circuit on May 23, 1910. The principal points upon which the defendant based its contention are (1) that the provisions of the act apply only to carriers doing business in or through a quarantined area, and not to terminal railroads operating wholly outside of a quarantined State or district and receiving from connecting carriers and transporting live stock originating in a quarantined area, and (2) that the act is unconstitutional in that it attempts to delegate legislative power to an executive officer. The decision of the court of appeals has not as yet been rendered.

In a case under the act of March 3, 1905, prosecuted in the western district of Texas, the defendant, the El Paso and Northeastern Railroad Company, was charged with transporting, without compliance with the regulations authorized by the act, two head of cattle originating in a quarantined portion of the State of Oklahoma and destined to El Paso, Tex. The shipment was received at the point of origin by a connecting carrier and transported by it to a point in New Mexico, where it was received by the defendant railroad and by it transported thence to destination. A demurrer to the indictment was interposed assigning several grounds for objection. The court, sustaining the demurrer, in a brief statement of its conclusions held (1) that the initial carrier receiving and transporting the shipment, and not the defendant railroad, was punishable under the act, since the latter did not transport from a quarantined district cattle destined to another State or Territory, and (2) that the indictment was defective in that it did not sufficiently allege the written or printed notice of the regluations by the Secretary of Agriculture to the proper officers of the defendant railroad company, required by the act, and (3) in that it failed to disclose that the Secretary of Agriculture had published the notice of the establishment of a quarantined district, required by the act (U. S. *v.* El Paso and N. E. R. Co., 178 Fed., 846).

Another indictment, amended as to the three objections last named, was not brought, inasmuch as the identical question raised in the first objection is involved in the case against the St. Louis Merchants Bridge Terminal Railway, discussed above.

During the fiscal year 21 orders of the Secretary of Agriculture, made and promulgated under the authority of the act of March 3, 1905, defining areas quarantined for contagious, infectious, and com-

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municable diseases of live stock, and declaring rules and regulations governing the interstate movement of live stock from such areas, were examined and approved; and also four orders of the Secretary of Agriculture prescribing regulations under the act of August 30, 1890 (26 Stat., 414), regulating the importation of cattle, sheep, and swine, and the act of February 2, 1903 (32 Stat., 791), "An act to enable the Secretary of Agriculture to more effectually suppress and prevent the spread of contagious and infectious diseases of live stock, and for other purposes."

The Office is always ready and prompt to respond to requests for assistance or suggestion in the prosecution of cases which have been reported to the Attorney-General and referred to the various United States attorneys, and correspondence of this nature, and the preparation of frequent briefs in support of the Government's contentions, is worthy of mention as no small item of time and work in the enforcement of the live-stock quarantine laws during the fiscal year.

MEAT INSPECTION AMENDMENT.

There were 52 violations of the meat inspection amendment of June 30, 1906 (34 Stat., 674), reported to the Attorney-General during the fiscal year 1910, while during the fiscal year 1909, 44 apparent violations of the same statute were similarly reported, thus making an increase in 1910 of 8 violations. Of the 52 cases reported during the year, 18 resulted in convictions, 8 were dismissed for lack of evidence as to the interstate shipment, and the remaining 26 are pending in the courts. Of the 44 cases reported during the fiscal year 1909, 15 resulted in convictions, 7 were dismissed for lack of evidence of interstate shipment or because service could not be obtained upon the defendant, and 22 were pending in the courts at the close of June 30, 1909. The following table embodies a statement of the 26 cases terminated during the fiscal year 1910:

Cases under meat inspection amendment of June 30, 1906, reported for prosecution during the fiscal year 1910.

M. I. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of case.
70	M. D. Tilley.....	Vermont.....	Shipment of immature veal from Vermont to Massachusetts.	Indicted; convicted; sentenced to jail for six months.
71	Frank Ignazi.....	Pennsylvania, eastern district.	Transportation of uninspected meat from Pennsylvania to New Jersey.	Indicted; pleaded guilty; fined $25.
74	Joseph Rosen.....	Michigan, western district.	Shipment of immature veal from Michigan to New York.	Indicted; convicted and imprisoned.
75	George H. Cady.....	New York, northern district.	Shipment of uninspected meat from New York through Pennsylvania to New York City.	Indicted; pleaded guilty; fined $50.
77	John C. Gordon.....	Maine.....	Shipment of unsound meat from Maine to Massachusetts.	Indicted; pleaded guilty.
79	H. C. Derby Co.....	New Jersey.....	Transportation of uninspected meat from New Jersey to New York.	Indicted; nolle prosequi entered.
80	.....do.....	.....do.....	.....do.....	Do.
81	.....do.....	.....do.....	.....do.....	Do.
82	.....do.....	.....do.....	.....do.....	Do.
83	Guisseppa Scozzari..	New York, southern district.	Shipment of uninspected meat from New York to New Jersey.	Indicted; pleaded guilty; fined $10.

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Cases under meat inspection amendment of June 30, 1906, reported for prosecution during the fiscal year 1910—Continued.

M. I. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of case.
84	Edward Lichtenstein.	Illinois, northern district.	Transportation of uninspected meat from Illinois to Indiana.	Indicted; pleaded guilty; fined $1,000 and sentenced to ten months in House of Correction.
85	Lebate & Lambrosa.	New York, eastern district.	Shipment of uninspected meat from New York to Pennsylvania.	Indicted; pleaded guilty; fined $50.
86	Schwarzschild & Sulzberger Co.	Connecticut.....	Shipment of uninspected meat from Connecticut to New York.	Indicted; pleaded nolo contendere; fined $500 and costs.
87	Joe Klobert.....	New Jersey.....	Transportation of uninspected meat from New York to New Jersey.	Indicted; pleaded guilty; fined $200.
90	B. J. King.....	.....do.....	Transportation of uninspected oleomargarine from New Jersey to New York.	Indicted; nolle prosequi entered.
92	W. C. Betts.....	New York, northern district.	Shipment of immature veal from New York to Pennsylvania.	Indicted; convicted; fined $50 and sentenced to 90 days' imprisonment; sentence suspended.
94	Joseph Klobert.....	New York, southern district.	Transportation of uninspected meat from New Jersey to New York.	Indicted; convicted and given sentence; court suspended sentence.
96	H. Kaminsky.....	.....do.....	Shipment of uninspected meat from New York to Pennsylvania.	Indicted; nolle prosequi entered.
98	Hoboken Butchers Supply Co.	New Jersey.....	Transportation of immature veal from New Jersey to New York.	Indicted; convicted.
100	P. Catalano.....	New York, western district.	Shipment of uninspected lard from New York to Pennsylvania.	Case withdrawn.
101	Amos Martindale....	Maryland.....	Shipment of immature veal from Maryland to Delaware.	Indicted; pleaded guilty; fined $1.
104	Joe Hellerud.....	Minnesota.....	Shipment of uninspected veal from Minnesota to Illinois.	Do.
107	Herrmann Ressler..	New York, southern district.	Shipment of uninspected meat from New York through New Jersey to High Falls, N. Y.	Indicted; on trial of case jury disagreed.
109	M. E. Wald.....	Minnesota.....	Shipment of uninspected veal from Minnesota to Illinois.	Indicted; pleaded guilty; fined $25.
110	H. Paul & Co.....	Massachusetts.....	Shipment of uninspected meat from Massachusetts to Rhode Island.	Indicted; pleaded guilty; fined Harry Wilkes, member of firm, $150.

Cases referred to in previous reports but which were not mentioned therein as being closed.

M. I. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of case.
2	A. C. Hunt & Co....	Massachusetts.....	Shipment of uninspected veal from Massachusetts to Connecticut.	Indicted; nolle prosequi entered.
5	E. Ellis.....	New York, southern district.	Shipment of 3 consignments of uninspected calves from New York through New Jersey to New York City.	Do.
10	J. D. Schults.....	.....do.....	Shipment of 14 immature calves from New York through New Jersey to New York City.	Indicted; on trial of case jury disagreed; nolle prosequi entered.
13	John Davis.....	New York, northern district.	Shipment of immature veal from New York to New Jersey.	Indicted; nolle prosequi entered.

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Cases referred to in previous reports but which were not mentioned therein as being closed—Continued.

M. I. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of case.
14	John Cooper.....	New York, southern district.	Shipment of immature veal from New York through New Jersey to New York City.	Grand jury failed to return indictment.
15	E. Ellis.....	.....do.....	.....do.....	Nolle prosequi entered.
16	E. Forshee.....	.....do.....	Shipment of 5 immature calves from New York through New Jersey to New York City.	Indictment returned; case pending.
17	J. Billecki.....	.....do.....	Transportation of uninspected and unwholesome beef tongues from New York to New Jersey.	Grand jury failed to return indictment.
18	A. Babiak.....	New York, eastern district.	Transportation of uninspected meat from New York to New Jersey.	Indicted; pleaded guilty; fined $100.
19	P. Marchitto.....	New York, southern district.	Transportation of uninspected beef from New York to New Jersey.	Indicted; case pending.
20	S. Block.....	.....do.....	Transportation of uninspected meat from New York to New Jersey.	Do.
21	J. Grasser.....	.....do.....	.....do.....	Indicted; nolle prosequi entered.
22	Samuel Nagel.....	.....do.....	Transportation of uninspected calves' livers from New York to New Jersey.	Indicted and case docketed.
23	E. S. Alpaugh & Co.	.....do.....	Transportation of uninspected veal from New York to New Jersey.	Do.
24	Nick Peters.....	Iowa, southern district.	Shipment of uninspected meat from Iowa to Illinois.	Indicted; pleaded guilty on Oct. 6, 1909; fined $75.
25	Henry Muhs.....	New Jersey.....	Shipment of sausages from New Jersey to New York from establishment from which inspection had been withdrawn.	Grand jury refused to return indictment.
26	W. Kuehnapfele....	New York, southern district.	Shipment of uninspected meat from New York to New Jersey.	Grand jury failed to return indictment.
29	E. A. Hanly & Co...	Massachusetts.....	Shipment of uninspected meat from Massachusetts to Maine.	Indicted; defendants pleaded guilty; fined $100 and costs.
32	Atlantic Hotel and Supply Co.	New York, southern district.	Shipment of uninspected meat from New York to New Jersey.	Prosecution of case abated by United States attorney.
34	Edward Rice.....	Wisconsin, western district.	Shipment of immature veal from Wisconsin to Illinois.	Indicted; no trial; whereabouts of defendant unknown.
36	Joseph Studer.....	Illinois, northern district.	Transportation of uninspected meat from Illinois to Indiana.	Indicted; pleaded nolo contendere; fined $100.
37	The Peter Deibel's Sons Co.	Ohio, northern district.	Shipment of unwholesome meat from Ohio to New York.	Prosecution of case abated by United States attorney.
38	Albany Rendering Co.	New York, northern district.	Shipment of uninspected meat from New York to Massachusetts.	Do.
40	Harry J. Furneaux..	Massachusetts.....	Shipment of uninspected meat from Massachusetts to Maine.	Grand jury refused to return indictment.
41	Thomas Bingham & Co.	New York, southern district.	Transportation of immature calves from New Jersey to New York.	Indictment returned; case pending.
43	A. Gunsenhiser & Co.	Massachusetts.....	Shipment of uninspected meat from Massachusetts to Rhode Island.	Grand jury refused to return indictment.
45	E. H. Ille.....	Georgia, southern district.	Transporting uninspected meat from Georgia to South Carolina.	Prosecution of case abated by United States attorney.
46	John Thallon & Co..	New York, eastern district.	Offering uninspected lard for export.	Indicted; pleaded guilty; sentence suspended.

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Cases referred to in previous reports but which were not mentioned therein as being closed—Continued.

M. I. case No.	Defendant.	Judicial district.	Nature of offense charged.	Disposition of case.
49	L. Giroux	Massachusetts	Shipment of unsound meat from Massachusetts to Rhode Island.	Prosecution of case abated by United States attorney.
52	Eckstrom & Krueger	Wisconsin, western district.	Shipment of unsound meat from Wisconsin to Minnesota.	Defendant pleaded nolo contendere; fined $50.
53	George M. Barnes	Connecticut	Shipment of unsound meat from Connecticut to Massachusetts.	Prosecution of case abated by United States attorney.
54	D. Mariotti	New York, southern district.	Shipment of uninspected meat from New York to Connecticut.	Nolle prosequi entered.
55	Edw. Lichtenstein	Illinois, northern district.	Transportation of uninspected meat from Illinois to Indiana.	Indicted; pleaded guilty; fined $100.
56	Swift & Co	Pennsylvania, western district.	Shipment of uninspected meat from Pennsylvania to Maryland.	Indicted; pleaded nolo contendere; fined $100 and costs.
57	A. Brondy	New York, southern district.	Transportation of uninspected meat from New York to New Jersey.	Pleaded guilty; sentence suspended.
58	E. G. Palmer	Pennsylvania, middle district.	Shipment of immature veal from Pennsylvania to New Jersey.	Pleaded guilty; fined $10 and costs.
59	J. Poleti & Co	New York, southern district.	Shipment of uninspected meat from New York to Vermont.	Pleaded guilty; sentenced to imprisonment for six months or pay a fine of $250. Fine was paid.
60	W. D. McArthur	do	Shipments of uninspected meat from New York to Massachusetts.	Indictment returned; case pending.
62	Joseph Klobert	New Jersey	Transportation of uninspected meat from New Jersey to New York.	Pleaded guilty; fined $25; sentence suspended.
63	Joseph De Christofano.	New York, southern district.	Shipment of uninspected lard from New York to New Jersey.	Case dismissed.
64	Jacob Dold Packing Co.	New York, western district.	Offering uninspected meats for interstate transportation.	Indicted; nolle prosequi entered.
65	Gill Vogel	Michigan, western district.	Shipment of immature veal from Michigan to Illinois.	Indicted; pleaded guilty; fined $25.
67	C. G. Stadelman, and Oscar Phillips.	Washington, eastern district.	Transportation of uninspected lard from Washington to Oregon.	Indictment returned; case set for trial.
68	H. C. Derby Co	New York, southern district.	Transportation of uninspected meat from New Jersey to New York.	Indicted; pleaded guilty; sentence suspended.
69	G. Brancati	do	Shipment of uninspected meat from New York through New Jersey to Sparkhill, N. Y.	Indicted; nolle prosequi entered.

Pittsburgh Melting Co. v. Pennsylvania R. R. Co.

On July 13, 1909, the Pittsburgh Melting Company filed a bill in equity in the circuit court of the western district of Pennsylvania against the Pennsylvania Railroad Company, seeking to compel the company to accept for transportation and to transport in interstate and foreign commerce oleo oil which had not been inspected, passed, and so marked by agents of the Department of Agriculture, as required by the meat inspection amendment (act of June 30, 1906; 34 Stat., 674). The bill alleged that this statute is unconstitutional, as being beyond the power of Congress to enact, and in violation of the fifth amendment; it was also asserted that the system of inspection provided for by the act does not relate to interstate commerce.

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In accordance with the request of the company, inspection was established in its plant on October 19, 1906, and maintained uninterruptedly until June 19, 1909. On that date the Department was advised that the company had received uninspected fat into its establishment, which is forbidden by the act and the regulations issued thereunder. It developed that the company was prepared to continue to receive such uninspected fat, and, accordingly, on June 23, 1909, inspection was withdrawn from their plant and the company notified that it was no longer authorized to make interstate or foreign shipments of meat or meat food products, nor to place on its products any reference to federal inspection.

The Pennsylvania Railroad Company and other transportation companies were notified of the Department's action. On June 26, 1909, the Pittsburgh Melting Company tendered a car containing 75 tierces of oleo oil which were not marked "U. S. inspected and passed," to the Pennsylvania Railroad Company for shipment in interstate and foreign commerce. The railroad company declined to receive the shipment, because it did not comply with the regulations of the Department, and thereupon the Pittsburgh Melting Company instituted the present suit to compel the company to receive and transport the same. In view of the fact that the constitutionality of the meat-inspection law was directly involved, the United States attorney, upon request of this Department, was directed by the Attorney-General to intervene on behalf of the United States. A very complete memorandum on the points of law raised in the case was prepared in this Office and transmitted to the United States attorney. As yet argument has not been heard in the case, though it is hoped that this will be done at the fall term of court. The suit is of very great importance to the Department, since it represents the most noteworthy of any of the contested cases thus far arising under the meat-inspection law.

THE LACEY ACT.

As stated in the Annual Report of this Office for the fiscal year 1909, sections 242 and 243 of the Criminal Code of the United States, effective January 1, 1910 (35 Stat., 1088), embody an amendment to the act of May 25, 1900 (31 Stat., 188), which obviated the difficulty of properly interpreting the intent of Congress in passing the latter measure. These sections require that all packages containing the dead bodies, or parts thereof, of game animals, game and wild birds, when shipped in interstate or foreign commerce, shall be plainly marked, so that the name and address of the shipper and the nature of the contents may be readily ascertained. It is believed that these sections, supplementing state game laws, will aid materially in their effective administration.

One case was reported under this act during the past fiscal year, arising in the district of Kansas, based on the shipment in interstate commerce of quail killed and offered for shipment in violation of the laws of Kansas, and not properly marked. This case is on the grand jury docket for the September term, district of Kansas.

During the year there was also reported another apparent violation of sections 242 and 243 of the Criminal Code in the shipment in interstate commerce of 264 quail killed in violation of the Kentucky

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statutes. Upon investigation it appeared impossible to establish that the party apparently guilty of the offense had actually shipped the game, and the case was abandoned upon the recommendation of the United States attorney.

Cases under the Lacey Act (act of May 25, 1900) coming over from previous years.

Case No.	Defendant.	Judicial district.	Offense charged.	Disposition or present status.
M 61	Northern Produce Co..	Texas, southern district.	Interstate shipment of wild ducks in package not properly marked.	Grand jury failed to return a true bill.
M 79	Guy Miller Produce Co.	Oklahoma, western district.	Interstate shipment of quail killed in violation of the laws of Oklahoma and shipped in boxes not properly marked.	Grand jury failed to return indictment.
M 80	Rabito-Battistella Fish and Oyster Co.	Louisiana, eastern district.	Interstate shipment of wild ducks in packages not properly marked.	Proceedings nolle prossed as to company; two members of firm fined $10 each.
M101	J. D. Carson.....	Iowa, northern district.	Interstate shipment of prairie chickens killed in violation of the laws of Iowa.	Defendant pleaded guilty; fined $25; paid.

An important decision, on a case arising under the Lacey Act (act of May 25, 1900; 31 Stat., 187), was handed down by the circuit court of appeals in Rupert *v.* United States (Circular No. 39, Office of the Solicitor). Rupert was indicted, convicted, and fined $100 and costs for shipping quail in interstate commerce, the same having been killed in violation of the laws of Oklahoma and with intent to ship the birds out of the Territory. On writ of error the court of appeals held that the Territory had authority to provide that quail should not be shipped out of its boundaries, even though the same was killed in open season; it was also held that the Lacey Act was constitutional and that Congress was empowered to require that interstate shipments of game should be plainly marked so as to show the contents.

TRESPASS ON BIRD RESERVE.

On or about January 22, 1910, the commander of the revenue cutter *Thetis* discovered 23 Japanese poachers in the act of killing a large number of birds on Laysan Island, which is one of the islands included in what is known as the "Hawaiian Island Reservation," set apart by the President in Executive Order No. 1019 on February 3, 1909, as a breeding ground for birds. The killing of these birds on the island of Laysan was in direct violation of the act of June 28, 1906 (34 Stat., 536, now section 84 of the Criminal Code, 35 Stat., 1088). About 259,000 bird wings in the possession of the Japanese were seized by the *Thetis;* the prisoners and their booty were afterwards delivered up to the United States marshal at Honolulu, Hawaii. Indictments were later returned against all the Japanese, and the plumage was turned over to the agent of the Department at Honolulu for storage.

An apparent violation of the act of June 28, 1906 (34 Stat., 536), in the shooting of pelicans and terns on the Mosquito Inlet bird reservation, near the mouths of the Halifax and Hillsboro rivers, Florida, was reported to the Attorney-General for appropriate action in the fiscal year 1909. This case was pending on criminal information filed December 6, 1909.

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LEGAL WORK FOR THE FOREST SERVICE.

GENERAL OUTLINE.

The scope of the duties of this Office was materially broadened and its work greatly increased during the fiscal year by your General Order No. 138 of January 15, 1910, directing that thereafter the legal work of the Forest Service be performed under the immediate supervision and direction of the Solicitor for the Department. Theretofore the bulk of this work had been done by a branch in the Service designated as "Law," composed of a law officer and assistants in Washington, together with assistants distributed in the six districts, with headquarters at Missoula, Mont., Denver, Colo., Albuquerque, N. Mex., Ogden, Utah, San Francisco, Cal., and Portland, Oreg. This branch of the Service handled several divisions of administrative work not connected with law, and it was realized, soon after the assumption of the duties enjoined by your order, that a separation of the work formerly done by that branch was necessary to bring the work of this Office properly within its functions. With this in view, as well as the necessity for reorganizing the work to bring it under the supervision of the Solicitor, as directed by your order, the administrative work theretofore done by the law officer of the Service was eliminated, and a reduction to three made in the number of assistants in Washington to handle the legal work. The reorganization of the Washington office was effected on February 2, and during that month a personal visit was made by me to each of the six districts for the purpose of reorganizing the branch offices in the field, as well as to select suitable assistants to carry on the work of the Office there. By the end of February the reorganization was completely effected. Two assistants were selected in each of the districts except the fifth, where it was thought the needs of the Service required but one.

Pending the complete reorganization of the branch of the Office employed on law work for the Forest Service, the designation of law officer of the Service, in Washington, and of district law officer, in the branch field offices, was retained, the law officer of the Service having offices in the building occupied by the Forest Service. When the reorganization of the entire force was effected, however, the position of law officer of the Forest Service was abolished; the law clerks of this Office in Washington, as well as in the field, who were engaged in law work for the Forest Service, were designated as assistants to the Solicitor, the designation of all law clerks in the employ of this Office. As stated, the entire force of the Office in Washington, including the law clerks employed on work for the Forest Service, is now assembled under one roof.

The duties of the representatives of this Office in the field in relation to the officers of the Forest Service are outlined in your order of March 31, 1910, in which you direct, in effect, that the district foresters will be the immediate representatives of and receive instructions from the Forester, and similarly that the assistants to the Solicitor in charge of the branches of this Office in the field will be the immediate representatives of and receive their instructions from the Solicitor; offices, equipment, clerical assistance, and traveling expenses are to be furnished by the Forester to the assistants to the

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Solicitor. The assistants to the Solicitor are constituted the legal advisers of the district foresters on all questions of law arising in the administration of the National Forests. Requests for formal opinions will be made by the district forester, and the assistants to the Solicitor will render their opinions thereon in writing. In matters of minor importance, where written opinions are not necessary, the chiefs of office may informally request and receive opinions from the assistants to the Solicitor. All correspondence with the Department of Justice in Washington and with the United States attorneys will be prepared and conducted by the assistants to the Solicitor. In contested claims cases regarding lands in the National Forests the assistants to the Solicitor will have complete charge as soon as adverse reports of forest supervisors are transmitted to the General Land Office. The intent of the order, as stated therein, is that the Forest Service shall handle no matters of law nor the Office of the Solicitor any matters of administration, and that the cooperation between the two branches of the Department shall be complete and cordial, in order that the largest extent of efficiency may be promoted thereby.

In this connection it should be stated that the officers of the Forest Service, both in Washington and in the field, have cooperated fully with this Office in every particular.

These two orders present a general outline of the work of this Office for the Forest Service. More specific and detailed instructions were given by the Solicitor to the district law officers in March, and the work has since proceeded smoothly and efficiently.

The work of the Office for the Forest Service comprehends five sharply defined and distinct divisions, each in itself imposing upon the Office a large volume of business. These divisions are opinions, contracts, claims, general legislation, and trespass settlements. The scope of each will be defined in its proper place as the separate headings are taken up for a report upon the work of the Office thereunder since January 15, 1910, the date of your order transferring the legal work of the Forest Service to the Solicitor.

OPINIONS.

One of the chief functions of the Office is to advise the Forest Service and the Secretary in all matters of law arising in the administration of the National Forests. Many questions are submitted to the Office which can safely be answered only after careful attention and exhaustive research of the decisions of the courts. Instructions were, therefore, early issued to all the district law officers that no opinion should be rendered for the guidance of the Forest Service in the administration of the National Forests in any case where a formal opinion is required until all the facts upon which the question calling for the opinion arises are submitted to them, nor until a careful and painstaking consideration of the question has been made. Many of the questions submitted to the Office by the Forest Service are of general application and may, and often do, arise in widely separated districts. With a view to uniformity and finality in the opinions on these questions, it is required that a copy of every formal opinion rendered by a law officer or his assistants shall be at once sent to the Solicitor and to each of the other district law offices. The district law officers are required to submit to the Solicitor their comments on the opinion as early as practicable. The Solicitor then examines the opinion for approval or modification, as necessity requires, and a

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decision is rendered thereon, returned to the law officer who rendered the opinion, and a copy sent each of the other district law officers, with instructions to follow the decision in future advice on the question to the Forest Service.

As might be expected, this system of handling the formal opinions of the Office has eliminated hasty and ill-considered advice, and the results have been most satisfactory. With the benefit of the independent judgment of six well-trained men on each question, the opportunity for error in a final decision of the question is reduced to the minimum. Many of the questions arising in the administration of the National Forests upon which the opinion of the Office must be given, embrace difficult problems of law, frequently questions of first impression, upon which there has been no judicial expression and often little to be deduced from decisions on allied branches of the law. With a vast area of the United States in National Forests, affecting directly and vitally many thousands of citizens, it is apparent that the duties of the Department of Agriculture in the administration of the forests must be exercised with care and circumspection. Legal questions touching the powers, duties, and responsibilities of the Department in this great trust must be carefully solved, and for the performance of this task it has been the endeavor during the year to equip the Office.

Since February 2, the date on which final reorganization of the work was effected, 51 formal opinions were rendered the Forest Service in Washington, and numerous informal opinions, of which no record was preserved, have been given daily. These informal opinions arise in conferences with members of the Forest Service and in the examination of correspondence submitted for consideration. Two decisions were rendered on formal opinions of the district law officers prior to June 30.

Aside from informal daily advice given the district foresters and their assistants by the district law officers during the period from January 15 to June 30, they rendered opinions and submitted comments on formal opinions of the district law officers as follows:

District No. 1:	
Formal opinions	21
Informal opinions	38
Comments	44
District No. 2:	
Formal opinions	14
Informal opinions	60
Comments	51
District No. 3:	
Formal opinions	12
Informal opinions	35
Comments	26
District No. 4:	
Formal opinions	5
Informal opinions	5
Comments	39
District No. 5:	
Formal opinions	14
Informal opinions	47
Comments	30
District No. 6:	
Formal opinions	18
Informal opinions	74
Comments	30

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CONTRACTS.

The contractual relations of the Department with beneficiaries of the National Forests and of the work of the Forest Service assume varied and often complicated forms, necessitating considerable skill in drafting instruments to meet the needs of the Service. Among the most important contracts of the year were two entered into between the Department and the Great Northern and Northern Pacific railroad companies for an effective system of fire patrol on the National Forests. Several contracts with state authorities and individuals for cooperative work in forest investigations and improvement of the National Forests were drafted during the year, and numerous leases of administrative quarters were either prepared or examined by the Solicitor and the district law officers for formal and substantial defects. Several deeds to the Government for lands required for the administration of the National Forests were examined and prepared for submission to the Attorney-General. One of the most important, time-consuming, and intricate phases of the contract work of the Department in relation to the National Forests is that incident to the execution of the act of February 15, 1901 (31 Stat., 790) empowering the Secretary of Agriculture to permit the use of rights of way over the National Forests for electrical and irrigation plants. During the year several important applications for such permits have been referred to the Solicitor for investigation and the preparation of the necessary instruments. There has been a well-defined disposition on the part of certain power companies in some of the western States to contest with the Department the authority of the Secretary to impose conditions upon the use of rights of way in the National Forests for power purposes. These companies have asserted with such persistence that they have rights beyond the control of the Secretary that during the latter part of the year it was determined to put them to the establishment of these rights and, accordingly, the facts in a typical case were referred to the Attorney-General for action. In addition to the power permits examined and prepared during the year, it was found necessary to revoke prior permits for breach of the terms and conditions. Prior to your general order directing that the legal work of the Forest Service be performed by the Solicitor, it had been customary to revoke these permits without notice to show cause against revocation. It was thought, however, that this procedure was a little too drastic in some instances. It is the present practice to notify the permittee that the Department is considering the revocation of his permit and afford him an opportunity to present such facts as he may deem pertinent in that connection. If, after a mature consideration of all the facts in the case, it is deemed proper to revoke the permit, the permittee is promptly notified of this action.

Much time has been saved during the year by the preparation of printed forms on which many of the contracts for the Forest Service are drafted. These blanks cover such phases of the work of the Department as grazing, minor timber, and similar special-use permits, and are filled in by the agents of the Department and the permittees, but are carefully scrutinized by the district law officers for proper execution and sufficiency, to cover the needs of each individual case.

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The number of contracts and leases prepared in the six districts since January 15, 1910, is shown in the following table:

District No. 1:	
Contracts	4
Bonds	3
Leases	29
District No. 2:	
Contracts	15
Bonds	15
Leases	30
District No. 3:	
Leases	18
District No. 4:	
Contracts	21
Bonds	20
Leases	41
District No. 5:	
Contracts	13
Leases	32
District No. 6:	
Bonds	9

CLAIMS.

Under this heading fall all the contests of the Department against claims to lands within the National Forests initiated and maintained under the public-land laws, much the larger number of which arise out of the homestead and mining laws. At the time this Office assumed the duties enjoined by your General Order No. 138, although the Department of the Interior had frequently held that the withdrawal of lands for National Forests constituted the Government, through this Department, an adverse claimant to lands entered under the public-land laws, the status of the Department in these contests before the Interior Department was more in the nature of one suggesting action to be taken by the latter Department than an adverse claimant invested with all the rights appertaining thereto. The procedure was somewhat informal and lacked directness. The necessity for a change in the procedure before the Interior Department was early realized and plans were formulated to effect the desired results. Action was not customarily taken by the Department on decisions of the Interior Department adverse to the United States until notice of the decision. Briefs were then prepared, accompanied by letters to the Secretary of the Interior requesting reconsideration of the cases. Naturally the Department of the Interior was averse to reopening the cases after full consideration had been given them, especially when no new evidence was adduced by this Department. Nevertheless, the Department was fairly successful in its contests and many valuable tracts of timbered lands were rescued from exploitation by speculators and designing entrymen. The work incident to these contests was not completely taken over by this Office until late in the year, owing to the press of other work for the Department and the informal manner of handling the claims. However, upward of twenty briefs were filed by this Office in the Interior Department.

Finally, on June 25, 1910, the efforts of this Office to place the claims work of the Department on a solid foundation resulted in joint order of the Secretary of the Interior and yourself, under

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which the Department was recognized as a contestant on an equal footing with all other contestants, and its legal department given full right of appeal from and motion of review of all adverse decisions of the Department of the Interior. In addition, this Office was accorded the right to be represented of record by its assistants at all hearings in the field and to participate in the examination of witnesses and production of evidence. It was further directed in this order that the chiefs of field division should consult with the assistants of this Office in the matter of setting dates for hearings. So far as the procedure before the Interior Department was concerned this order was effective, and secured to the Department of Agriculture a status of equal rank with all contestants and placed the work on a solid foundation.

The method of handling the initiatory steps of the work in the Department needed reform. In their commendable zeal to preserve the lands within National Forests from unlawful appropriation, rangers and supervisors, whose duty it was to report on all claims in their respective territories, sometimes submitted adverse reports upon claims of meritorious character, resulting in great expense and annoyance to the claimant and equal expense to the Government when hearings were ordered by the Interior Department. With a view to obviating this, to give effect to your determination not to make difficult and expensive the acquisition of homes by honest, well-intending, and deserving citizens, who comply substantially with the requirements of the law, as well also, in order that you might more directly exercise a supervision over the claims work of the Department, a draft of instructions to the district forester and district law officers was submitted to you for approval on June 28, and by its approval on that date a new order of handling the work was put into immediate effect. By this order no report of the Forest Service adverse to the claimant is permitted to go to the Secretary of the Interior until all the facts in the case are submitted to you for a determination of the propriety and necessity for a hearing. By this course the possibility of injuring the claimants, with no real benefit to the United States, will be reduced to the minimum, if not altogether eliminated.

The order will largely increase the work of this Office, which theretofore had no part in the proceedings until hearings were directed by the Interior Department. All the reports of the Forest Service adverse to claimants must now be submitted to the Solicitor for examination as to the sufficiency of the law and evidence to sustain adverse proceedings. If the facts submitted appear, in the judgment of the Solicitor, to be insufficient, and it seems possible to supply the deficiency, the papers will be returned to the Forester for further action looking to procurement of additional evidence. When all the available evidence is secured, a recommendation is made by the Solicitor to you, and the Secretary of the Interior is requested either to order a hearing or to take no adverse action, as the examination of the reports justifies. When hearings are ordered, the assistants to the Solicitor in the respective districts are promptly notified, and dates are set, as before stated, in accordance with the cooperation of the chiefs of field division. At the appointed time for the hearing, the Office is represented by one of its assistants,

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who is required and authorized to take part therein on behalf of the Department. If the decision of the register and receiver is adverse to the United States, the assistants in this Office are required to prepare a brief to be filed with the papers in the case for transmission to the Commissioner of the General Land Office for his consideration in connection with the case. A copy of this brief is sent at once to the Solicitor, together with a copy of the testimony, and if additional argument is thought to be necessary, the Solicitor takes the required action. If the decision of the Commissioner be unfavorable to the United States and appears, in the opinion of the Solicitor, to be erroneous, an appeal is likewise taken to the Secretary and either oral argument had, or a brief is submitted. The former cumbersome, unsatisfactory, and ineffective practice of submitting briefs after a decision of a case, has been supplanted by the orderly procedure of submitting argument prior to a decision.

Under the old system of handling the claims cases of the Department the district law officers had a large volume of work during the period from January 15 to June 30. Much the larger portion of this time was devoted to this branch of the work of the Office. Though without having the substantial footing secured by the joint order of June 25, 1910, of the Secretary of the Interior and yourself, they were able to represent the Department at numerous hearings and to render valuable assistance to the chiefs of field division, as well as to direct necessary investigations to determine the validity of claims. An idea of the magnitude of this work is suggested by a summary of the cases handled in the six districts by the district law officers in the last five and one-half months of the fiscal year, during which the work was done under the direction of the Solicitor.

District No. 1.—On January 15, 1910, there were pending in this district 265 cases, 45 of which were finally concluded before the end of the year, 16 in favor of the claimants, resulting in issuance of patents, and 29 in favor of the United States, resulting in cancellation of the entries and a saving to the Government of 4,570 acres, supporting 46,680,000 feet board measure of merchantable timber valued at $186,720. The remaining cases were pending at the close of the year and were augmented during that period by 51 new cases, introducing the new year with 271 cases to be handled in this district alone. Some of the cases decided in favor of the United States during the year involved mineral claims.

District No. 2.—In this district action was taken by the district law officer in 95 cases, 62 of which were decided in favor of the United States, 17 adversely to the United States, in 8 cases relinquishments were made, contests were withdrawn in 7 cases at request of the Department, and 1 squatter location was abandoned. There were 326 claims cases pending in this district on January 15, 1910. At the end of the fiscal year there remained still open 255, including addition of new cases during the period covered by this report.

District No. 3.—In this district action was taken by the district law officer in 284 cases, 117 resulting in the issuance of patents and 94 in cancellation of entries. There were pending at the close of the year 344 cases, consisting of those in which no action had been taken prior to June 30 and new cases referred during the period from January 15 to June 30.

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Owing to many difficulties in the administration of the Arkansas National Forest, together with concerted action on the part of residents in that locality to acquire lands and timber in the forest apparently without right and in willful disregard of the laws, the district law officer spent the entire month of March and almost the whole of February and April in this Forest and in the vicinity investigating the causes of friction and the validity of claims to lands in the Forest.

District No. 4.—In this district action was taken by the district law officer in 45 cases, in 9 of which the entries were held for cancellation, in 3 decisions were adverse to the Government, and the remainder were pending at the close of the year on orders for hearings.

District No. 5.—On January 15, 1910, there were pending in this district 264 cases. This number was increased before the expiration of the fiscal year by 60. During this period 35 cases were closed, 27 resulting favorably to the United States and 6 to the claimant. One contest was dismissed at the request of the Department, and 2 squatter claims were abandoned. On June 30 there were still pending 289 cases.

District No. 6.—On January 15, 1910, there were pending in this district 518 cases, and during the period covered by this report 53 new cases were added. Of this number 61 were closed during the year, 38 having been decided favorably to the United States and 23 to the claimants. Those in which the United States were successful represented 5,442 acres of land valued at $27,210, supporting 66,555,000 feet of timber valued at $199,665. In 22 cases the hearings were attended and partially conducted by the district law officer or his assistant. At the close of the year 510 cases were still pending.

It has been found impracticable in a report limited in character as this must be, to include a complete table of these claim's cases. To do so would greatly lengthen the detail of the report and at this time serve no indispensable purpose. It has been thought sufficient to present a synopsis of this branch of the work.

GENERAL LITIGATION.

Under this designation fall all those cases in which action is contemplated or taken in the courts. The work necessary to prepare the cases for submission to the Attorney-General requires careful and painstaking attention. No case is thus submitted until the evidence is collected and sifted, to the end that only such as make out a prima facie showing shall be reported for action in the courts. Except in a few instances the cases are prepared by the assistants to the Solicitor in the several districts and the letter written there and sent with all the papers to the Solicitor, for examination preparatory to signature by the Secretary. Much the larger number of cases investigated by the Office never reach the Attorney-General, usually because of inability to secure proper evidence. Yet the work involved in these is as time-consuming and laborious as that necessitated in cases which are so reported. This report does not attempt to set forth those cases in which no report was made to the Attorney-General, or in which settlements of controversies have been secured through demands by the Department, such as removal of unlawful fences.

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The work of this Office does not end with the reference of a case to the Attorney-General. Very often the most important work has then just begun. During the period covered by this report the district law officer, in each district, cooperated freely with the United States attorneys, frequently appearing in court and assisting in the trials. Numerous briefs on argument have been prepared, submitted to, and filed by the United States attorneys, and not infrequently the district law officers have prepared, in whole or in part, pleadings which were filed in the case. The cooperation between this Office and the United States attorneys has been most cordial and effective.

The two appended tables are designed to show briefly the cases reported to the Attorney-General for civil or criminal action since January 15, 1910, the date on which all the legal work of the Forest Service was transferred to the Solicitor; the disposition of cases during that period; and those pending on June 30, 1910, the close of the fiscal year. A column has been inserted to indicate in which one of the Department's six districts the case arose.

Cases reported to the Attorney-General for institution of civil suits disposed of during the last five and one-half months of the fiscal year 1910, or pending at its close.

Defendant.	Judicial district.	Cause of action.	Department of Agriculture district.	Disposition or present status.
Chicago, Milwaukee and St. Paul Ry. Co.	Idaho	Suit in equity to compel execution of stipulation for protection of national forest, and for $67,000 damages to forest.	1	Demurrer to bill overruled; pending on answer to amended bill.
Bonners Ferry Lumber Co.	do	Timber trespass. Damages, $2,523.36.	1	Pending on demurrer to answer.
G. D. Gorus	Montana	Timber trespass. Damages, $322.60.	1	Reported to Attorney-General; pending.
Great Northern Ry. Co.	do	Setting fire to timber on national forest. Damages, $812.30.	1	Pending on answer to complaint.
T. L. Greenough	do	Timber trespass. Damages, $241,000.	1	Pending negotiations for settlement.
S. B. and J. E. Herron.	Idaho	Timber trespass. Damages, $1,147.25.	1	Reported to Attorney-General.
Hope Lumber Co.	do	Timber trespass. Damages, $709.84.	1	Complaint filed; pending.
Idaho Transportation Co.	do	Breach of contract. Damages, $17.19.	1	Do.
Iron Mountain Tunnel Co.	Montana	Timber trespass. Damages, $707.85.	1	Judgment for $707.85 paid in full.
John King	do	Timber trespass. Damages, $228.37.	1	Judgment for $228.37; defendant relieved under pauper statute.
W. B. Russell	do	Timber trespass. Damages, $2,528.90.	1	Complaint filed; pending.
Herman Vogel	Idaho	Negligent setting of fire in national forest.	1	Dismissed; evidence insufficient to sustain suit.
Goemmer & Goemmer.	Colorado	Cancellation of patents procured through fraud.	2	Bill filed; pending.
Fred Light	do	Injunction to restrain grazing trespass.	2	Restraining order granted. Pending on appeal in Supreme Court of United States.
Safe Investment Gold Mining Co.	South Dakota	Suit to set aside patents to mining claims; 1,118 acres. 4,000,000 feet timber.	2	Reported to Attorney-General; pending.
Telluride Power Co.	Colorado	Breaking of dam. Damages, $1,578.22.	2	Reported to Attorney-General; pending.
Chicago, Burlington and Quincy R. R. Co.	South Dakota	Negligent setting fire to timber. Damages, $42,793.08.	2	Complaint filed; pending.

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Cases reported to the Attorney-General for institution of civil suits disposed of during the last five and one-half months of the fiscal year 1910, or pending at its close—Continued.

Defendant.	Judicial district.	Cause of action.	Department of Agriculture district.	Disposition or present status.
Missouri River and Northwestern R. R. Co.	South Dakota	Negligent setting fire to timber. Damages, $3,728.85.	2	Complaint filed; pending.
Denver, Northwestern and Pacific R. R. Co.	Colorado.....	Negligent setting fire to timber. Damages, $5,440.04.	2	Reported to Attorney-General; pending.
Fleming Bros.....	.....do.....	Timber trespass. Damages, $1,978.37.	2	Do.
J. G. Le Sarre.....	Illinois, northern district.	Negligent setting fire to timber. Damages, $452.43.	2	Complaint filed; pending.
J. C. Teller and Union Pacific R. R. Co.	Colorado.....	Timber trespass. Damages, $316,071.10.	2	Do.
John C. Rice.....	.....do.....	Timber trespass. Damages, $24,872.	2	Compromised for $1,080.35 and costs.
T. W. Barnes.....	.....do.....	Timber trespass. Damages, $58,000.	2	Compromised for $7,500.35; lack of sufficient evidence to maintain entire claim.
Safe Investment Gold Mining Co.	South Dakota....	Timber trespass. Damages, $3,064.35.	2	Reported to Attorney-General; pending.
F. P. Moran.....	Colorado.....	Grazing trespass. Damages, $14.75.	2	Judgment for $14.75 paid in full.
Clemente Mestas.....	New Mexico, first.	Occupying land in national forest.	3	Suit in ejectment filed; pending.
Margarito Romero.....	New Mexico, fourth.	Timber trespass.....	3	Pending before referee.
W. P. McIntosh.....	Arkansas, western district.	.....do.....	3	Reported to Attorney-General; pending.
Pecos Copper Co.....	New Mexico, fourth.	.....do.....	3	Do.
Telluride Light and Power Co.	Utah.....	Unlawful occupancy of lands in national forest for power purposes.	4	Reported to Attorney-General; pending.
James Farmer.....	Idaho.....	Action to restrain grazing trespass.	4	Temporary injunction granted.
Estaben Anduiza.....	.....do.....	.....do.....	4	Do.
R. L. & A. B. Higley..	Washington.....	Unlawful occupancy of land in national forest. Action of trespass.	6	Reported to Attorney-General; pending.
N. P. Tippett.....	Oregon.....	Grazing trespass. Damages, $65.60.	6	Reported to Attorney-General; pending.
Cannon, Entiat Lumber and Power Co.	Washington.....	Timber trespass. Damages, $1,169.	6	At issue; ready for trial.
Holcomb & Prewitt....	.....do.....	Timber trespass. Damages, $2,677.43.	6	Do.
Corvallis and Eastern Ry. Co.	Oregon.....	Negligent setting fire to timber on national forest. Damages, $10,703.	6	Judgment for $4,424.38; company appealed to circuit court of appeals; pending.
Northern Pacific Ry. Co.	Washington.....	Negligent setting fire to timber on national forest. Damages, $5,299.50.	6	At issue; ready for trial.
Clearwater et al lodes, E. C. Baird, claimant.	.....do.....	Suit to cancel mineral patent.	6	Reported to Attorney-General; in hands of United States attorney.
Diteman & Rennie....	.....do.....	Grazing trespass.....	6	Suit settled for $378; paid in full.
D. C. Smith.....	Oregon.....	Suit for cancellation of homestead patent.	6	Bill filed; pending.
Milton S. Turnbull....	.....do.....	Timber trespass.	6	Suit dismissed. Evidence not sufficient.
S. J. Harris.....	California, southern district.	Occupancy of lands in national forest without title. Ejectment.	5	Pending on demurrer to bill.
Jenkins-Castoic Mining Co.	.....do.....	.....do.....	5	Do.
H. Linton.....	California, northern district.	.....do.....	5	Reported to Attorney-General; pending.
C. P. Mason.....	.....do.....	Suit to cancel patent....	5	Replication filed; pending.
P. S. Mason.....	.....do.....	.....do.....	5	Do.
H. F. Melville.....	.....do.....	Timber trespass. Damages, $52.	5	Pending dismissal.

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Cases reported to the Attorney-General for institution of civil suits disposed of during the last five and one-half months of the fiscal year 1910, or pending at its close—Continued.

Defendant.	Judicial district.	Cause of action.	Department of Agriculture district.	Disposition or present status.
H. T. Powers	California, northern district.	Timber trespass. Damages, $760.40.	5	Pending adjustment of railroad grant.
Trinity B. T. M. Co.	do	Timber trespass. Damages, $247.82.	5	Pending.
J. Artaesan	California, southern district.	Occupancy of land in national forest without title; ejectment.	5	Pending on demurrer to bill.
Wm. Metcalf	California, northern district.	Timber trespass. Damages, $1,700.35.	5	Reported to Attorney-General; suit directed; pending.
Northern California Mining Co.	do	Injunction to restrain trespass.	5	Bill filed; pending.

Cases reported to the Attorney-General for criminal action, disposed of during the last five and one-half months of the fiscal year or pending at its close.

Defendant.	Judicial district.	Nature of offense.	Department of Agriculture district.	Disposition or present status of the case.
Harley Bishop	Idaho	Attempt to bribe employee of Forest Service.	1	Indictment returned; defendant not yet apprehended.
S. B. and J. B. Herron	do	Timber trespass.	1	Pending.
Frank J. Hopkins and William Kellar.	do	Maintaining saloon on national forest, in violation of regulation of the Secretary.	1	Pending on demurrer to indictment; argument closed.
Basil and Charles Rizzinelli.	do	do	1	Do.
John Culhane and Ed Santry.	do	do	1	Do.
Lee Setser and William Lynch.	do	do	1	Do.
Iron Mountain Tunnel Co.	Montana	Timber trespass.	1	Indictment returned; pending.
T. A. Lawrence	Idaho	Embezzlement	1	Indictment returned; defendant not yet apprehended.
T. W. Barnes	Colorado	Timber trespass.	2	Dismissed.
John C. Banks	Arkansas, northern district.	do	3	Indictment returned; nolle prosequi entered.
A. N. Bloylock	do	do	3	Do.
Sam Cope, sr., Sam Cope, jr., and Howard Cope.	New Mexico, eighth.	Grazing trespass.	3	Sam Cope, jr., arrested and bound over to await action of grand jury; Sam Cope, sr., not yet apprehended.
Soloman H. Kilbury	Arkansas, western district.	Timber trespass.	3	Indicted; pleaded guilty; fined $100 and sentenced to thirty days in jail; sentence suspended.
R. B. Lane	do	do	3	Indicted; nolle prosequi entered.
James Lawrence	do	Setting fire on national forest.	3	Indictment returned; not yet apprehended.
J. R. Rollins	Arkansas, eastern district.	do	3	Indicted; pleaded guilty; fined $1 and costs.
Moses Small	Florida, northern district.	do	3	Indicted; pleaded guilty; fined $10 and costs.
J. A. Smith	Arkansas, western district.	Timber trespass.	3	Indicted; tried, found guilty, and fined $100 and costs.
Walter Tollman	do	do	3	Indicted; pleaded guilty; fined $100 and costs.

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Cases reported to the Attorney-General for criminal action, disposed of during the last five and one-half months of the fiscal year or pending at its close—Continued.

Defendant.	Judicial district.	Nature of offense.	Department of Agriculture district.	Disposition or present status of the case.
Charles N. Tuttle	Arkansas, eastern district.	Timber trespass	3	Arrested; discharged by United States commissioner; awaiting action of grand jury.
Andrew Ott	do	Setting fire on national forest.	3	Grand jury failed to return indictment; will be again presented.
J. D. Tindall	Nevada	Unlawful use of mining claim.	4	Held under $500 bail to await action of grand jury.
C. F. Henry	do	do	4	Do.
J. D. Mattive	do	do	4	Do.
R. R. Dale	do	do	4	Do.
J. Jenkins	do	do	4	Do.
R. R. Baty	do	do	4	Do.
J. M. Powers	do	do	4	Do.
James Telfer	Idaho	Grazing trespass	4	Held under $250 bail to await action of grand jury.
Jos. Calsacarto	do	do	4	Held under $300 bail to await action of grand jury.
Anestaria Gabialo	do	do	4	Held under $100 bail to await action of grand jury.
Edward Newman and James Wallace.	do	do	4	Held under $500 bail to await action of grand jury.
S. L. Seifert	do	do	4	Do.
Estaben Anduiza	do	do	4	Held under $300 bail to await action of grand jury.
C. D. Ramsey	do	Unlawful use of mining claim.	4	Held under $200 bail to await action of grand jury.
W. A. Fletcher	do	do	4	Dismissed by United States commissioner.
E. G. Gardner	do	Setting fire on national forest.	6	Indicted; pending.
Diteman and Rennie	Washington	Grazing trespass	6	Demurrer to indictment pending for argument.
Grimaud and Carajous.	California, southern district.	Grazing sheep on national forest without permit.	5	Court sustained demurrer to indictment; Government appealed to Supreme Court; judgment of trial court affirmed by even division of the justices; rehearing granted in April on petition of Solicitor-General; pending.
A. Inda	do	do	5	Do.
H. Clay	do	Setting fire to timber on national forest.	5	Ready for trial September 16, 1910.
Robb & Allen	do	do	5	Grand jury failed to indict.

Several of the above-stated cases deserve more extended explanation.

The suit against the Chicago, Milwaukee and St. Paul Railroad Company was instituted to compel a specific performance of a written agreement whereby the company agreed, in consideration of the Secretary's permission to construct its road over the Coeur d'Alene National Forest, to execute certain stipulations for the protection of the Government against damage resulting from the

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construction and operation of the railroad. After the road was constructed the company refused to execute the stipulation. During the course of construction the company cut and used large quantities of timber and cast into the St. Joe River quantities of stone and débris, thus obstructing the navigability of the stream and lessening the value of the timber on forest lands. The bill also prayed damages for the injuries caused by the cutting of the timber and the obstruction to the river. The company demurred to the bill. The demurrer was overruled on February 12, 1910, the court holding that the Secretary had the power and authority to require the stipulations. (See Circular No. 32, Office of the Solicitor.) The case was pending on answer to the amended bill at the close of the year.

Several indictments were returned during the year against persons who were conducting saloons on the National Forests in violation of the regulations for the protection of the Forests. Some of these cases involve the much-mooted and, as yet, undetermined, question of the right of a mineral locator to conduct a saloon on his claim, despite the regulation of the Department prohibiting its maintenance in a National Forest. Four of these cases in Idaho have been argued and elaborate briefs filed by the United States and defendants, and the court had them under consideration at the close of the year. In these four cases the district law officer at Missoula, Mont., practically prepared and conducted the entire argument for the Government. He secured the indictment against the defendants. The issue in these cases is of vast importance to the successful administration of the National Forests, and a decision thereon is awaited with much interest both to the Department and the people living in and adjacent to the Forests.

Of great interest during the year was the action of the Supreme Court in the cases of the United States *v.* Grimaud and Carajous, and United States *v.* Inda, both arising in the southern district of California upon indictments in the district court for grazing sheep on the Sierra National Forest without permits from the Secretary, and in violation of the regulations of the Department. The district court sustained demurrers to the indictments on the ground that the act of June 4, 1897, under the authority of which the regulations were made and promulgated, was unconstitutional in so far as it authorized the Secretary to make the regulations and imposed penalties upon anyone violating them. It was held that the authority to make these regulations was a delegation of legislative power and unauthorized by the Constitution. The Government took a writ of error direct to the Supreme Court, where, in March last, without filing an opinion, the court affirmed the judgment of the district court by an even division of the justices, the effect of which was a disposition of those cases, but no binding authority in subsequent cases of the same nature. The Solicitor-General petitioned for a rehearing, so that the cases might be heard by the entire bench and a final decision on the question rendered. On April 13 following the court granted the prayer of the petition, and the cases will be reargued during the coming fall. No case could arise of more far-reaching importance than these, involving as they do the authority of the Secretary to make prohibitive regulations for the protection of the National Forests.

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A case somewhat similar, though not involving a prosecution as for a crime, originating in Colorado, has been removed by the defendant, Fred Light, to the Supreme Court and is now pending. In this case an injunction was granted by the circuit court to restrain Light from grazing sheep on the National Forest without a permit from the Department. It is alleged by the defendant that the regulations of the Secretary requiring a permit are void. This question was thought to have been authoritatively settled by the circuit court of appeals for the ninth circuit in Dastervignes et al *v.* United States (122 Fed., 30).

In the case against the Bonners Ferry Lumber Company, pending in the district court of the United States for the district of Idaho, the State of Idaho is defending the action on the ground that the grant by Congress to the State of sections 16 and 36 for public schools is a grant in præsenti which conveyed to the State full title though the sections were unsurveyed, so that the subsequent inclusion of the lands in a National Forest did not deprive the State of them. This question has been decided to the contrary by the Department of the Interior and the Attorney-General. Its final solution will settle a number of vexatious questions continually arising in the administration of the National Forests embracing unsurveyed sections 16 and 36.

In the case against the Great Northern Railway Company, pending in the district of Montana, there is involved the right of the United States to recover the prospective value of immature trees and young growth destroyed by the fire set through negligence of the company.

The case against John C. Teller and the Union Pacific Railroad, pending in Colorado, involves a demand for $316,071.10, the value of timber cut from approximately 5,600 acres and sold by Teller to the railroad company. An immense mass of evidence has been accumulated by the Department and the district law officer has had numerous consultations with the United States attorneys handling the case with a view effectually to establish the Government's claim in full. The defendants have made several offers of compromise, but of so unsubstantial a character that the Department has declined to recommend an acceptance, and the case will be pressed to an early trial and conclusion.

While not embraced in the litigation of the Department during the year, there is nevertheless much importance to be attached to the decision of the circuit court for the district of South Dakota, rendered on March 8, 1910, in the case of the United States *v.* Bailey (178 Fed., 302). The decision is judicial authority for the action of the Department in requiring stipulations for the protection of the United States from damage by reason of the use of the National Forests for railroad or any other purposes. In the above case the Missouri and Northwestern Railway Company had applied to the Secretary of the Interior for a right of way through the Black Hills National Forest. The Secretary of the Interior required the company to furnish a bond to the United States with sufficient surety for the protection of the National Forest against fire, etc. The company started a fire on the Forest which destroyed timber to the value of $6,175. This was a suit to recover this amount from Bailey, the receiver of the company, and the surety. The defendants demurred to the complaint on the ground, among others, that there was no statute authorizing and

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requiring a bond on behalf of the United States as a condition precedent to the grant of a right of way over a forest reserve, and that the bond sued on was extorted from the company and was without consideration. The court decided adversely to the defendants, overruled the demurrer, and held:

Under act of Congress of March 3, 1899 (ch. 427, 30 Stat., 1233), authorizing the Secretary of the Interior to file and approve surveys and plats of a right of way for a railroad over any forest reservation when in his judgment the public interest will not be injuriously affected thereby, the Secretary was authorized to enforce, as a condition of his granting a railroad right of way over a forest reservation, that the company execute a bond to pay to the United States all damages to public lands, timber, natural curiosities, or other public property on the reservation by reason of the company's occupation.

In addition to the cases in the federal courts there were pending during the year several cases in the state courts in which the Department was vitally interested. One of these, worthy of special consideration, was a suit in replevin in the circuit court of Custer County, S. Dak., against a forest ranger for recovery of a large quantity of timber unlawfully cut on a National Forest and seized by the ranger. Judgment was recovered against the ranger for $4,400 and costs. A compromise was effected by which the judgment was released and $200 paid by the plaintiff to the United States. In all these cases the district law officers took an active part.

TRESPASS SETTLEMENTS.

These include all those cases where resources of the National Forests are taken or destroyed by trespassers, unaccompanied by willful intent, and which are settled by the Secretary, without suit, on the basis of the actual value of the resources.

Prior to January 15, 1910, when the legal work of the Forest Service was committed to this Office, all civil trespasses on the National Forests were settled by the employees of the Service, regardless of the character or intent of the trespass, and in willful cases exemplary damages were demanded and collected, and only those cases in which no settlement could be effected were reported to the Attorney-General. In many instances arbitrary amounts were levied as punitive damages, and men were required to pay for trespasses unaccompanied by any evidence of knowledge of the trespass or of willful intent. This system of administering the Forests led to much friction and bitter feeling against the Department. Believing that there was no warrant in law for the settlement by the Department of willful trespasses, and that all trespass cases should be reported to the Secretary for his determination of the amount due the Government or of the proper disposition of the matter, the Solicitor, at the direction of the Secretary, revised the instructions for the handling of grazing cases and provided therein that the officers of the Forest Service should submit a full report of each case to the Forester; that the Forester should make his recommendations thereon and refer it to the Solicitor for examination as to the sufficiency of the law and evidence; and that the report, with the recommendation of the Solicitor, should be submitted to the Secretary for his determination of the damages sustained by the Government or for further action as the facts in the case might require. Those cases developing no willful

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or malicious intent are settled by the Secretary upon demand of the actual damages sustained by the United States. If the trespass is willful or malicious, the case is reported to the Attorney-General for suit, with a request that exemplary damages be also demanded. This revised procedure was not effectively put into operation till near the close of the year, and in consequence no cases were referred to the Solicitor prior to June 30, though the district law officers passed upon a large number of settlements under the old scheme during the period from January 15 to June 30. Near the close of the year instructions were also issued to all forest officers to follow the grazing instructions in handling timber trespasses on the Forests. These instructions will materially enlarge the work of this Office, and it is believed will put the trespass feature of the work of the Department on a solid, substantial, and business-like basis, and will entirely remove the adverse criticism of the Department which was so prevalent under the old arbitrary practice of handling these cases.

MISCELLANEOUS CASES.

CONVERSION OF PROPERTY OF THE DEPARTMENT.

As stated in the preceding report, in two instances former cooperative Weather Bureau observers retained, after their appointments had expired, the valuable meteorological instruments loaned them by the Department. Proceedings were instituted, at the request of this Office, and in the two cases pending at the close of June 30, 1909, the property was recovered. The Office was not called upon to recommend similar proceedings in any case during the fiscal year 1910.

CASE IN THE COURT OF CLAIMS.

Thomas H. Reeves *v.* United States, Court of Claims No. 30615, a suit involving a claim for salary alleged to be due the petitioner from this Department was still pending at the close of the fiscal year 1910; suit was filed on May 16, 1907; the last docket entry was under date of February 27, 1909, when certain Department records, called for by the petitioner, were filed.

FALSIFICATION OF ACCOUNTS.

On June 29, 1910, Philip L. McBreen, formerly a veterinary inspector of the Bureau of Animal Industry, was indicted in the middle district of Alabama for a violation of sections 5392 and 5438, Revised Statutes, for making and presenting for approval false claims for livery service, knowing the same to be fraudulent. McBreen was apprehended at Pittsburg, Pa., and gave bond in the sum of $1,000 to await his trial, which will probably take place at the fall term of court.

Robert E. Taylor, also a former veterinary inspector of the Bureau of Animal Industry, was indicted for a similar offense in the western district of North Carolina, apprehended in New York, and removed to Winston-Salem for trial. He will be tried at Greensboro, N. C., at the December term, 1910.

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SUIT AGAINST DEPARTMENT INSPECTOR.

On April 26, 1910, judgment was entered in the sum of $764.75 against the defendant, an inspector of the Bureau of Animal Industry, in Gutierrez *v.* Wiley. The suit was based on the following circumstances: On August 29, 1908, Inspector Morris C. Wiley, of the Bureau of Animal Industry, dipped 2,019 head of sheep, the property of Justiniano Gutierrez, of Albuquerque, N. Mex., at the dipping station in Bernalillo County, N. Mex. At the time Doctor Wiley was acting in cooperation with the territorial authorities in the enforcement of their regulations for the eradication of sheep scabies. He used the ordinary dip employed by inspectors of the Bureau of Animal Industry for the purpose and approved by the Department. He exercised due care in handling the sheep during the operation. Gutierrez asserted that 319 head of sheep from the flock died as a result of the inspector's negligence, though it appears that the sheep had been without water for five days previous to dipping and were in very poor condition at the time. Proceedings were instituted against Inspector Wiley by Gutierrez on October 13, 1908, $1,276 being claimed; judgment was entered, however, for but $764.75. The case is now pending on appeal. Execution was about to be sought in this case, but the assistant to the Solicitor at Albuquerque, acting under instructions from this Office, and being on the ground, obtained a stipulation from counsel delaying execution long enough to permit steps to be taken looking to an appeal.

PREPARATION OF LEGAL INSTRUMENTS, CONTRACTS, LEASES, AND BONDS.

It would appear that the number of contracts and leases prepared during the fiscal year 1910 was not as great as the number of similar instruments prepared in the preceding fiscal year. The discrepancy is due to the fact that the general supply committee prepared all the supply agreements heretofore drawn in this Office, leaving only a small number to be drawn in the Department of Agriculture. Disregarding the supply contracts prepared in the fiscal years 1909 and 1910, the records of the Office show that there was a larger number of contracts and leases prepared for practically every Bureau in the Department in 1910 than in 1909. In addition to the preparation of all legal instruments to which the Department is a party, this Office passes upon the sufficiency of the execution of the same. In all, there were 409 agreements and 87 bonds prepared by the Office during the fiscal year 1910, the execution of the same being also scrutinized; of this number 356 agreements and 30 bonds were prepared by the main office in Washington, and 53 agreements and 57 bonds were prepared by the assistants to the Solicitor in the field. The bonds mentioned are those given by disbursing officers of this Department in accordance with section 174, Revised Statutes. Several requests for certified copies of contracts with the Department for construction work were prepared and furnished to subcontractors, in accordance with the act of February 24, 1905 (33 Stat., 812), in order that proceedings might be instituted on the bonds given in connection with such agreements. The greater part of the experiment

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work of the Department throughout the country, particularly in the growing of crops, is carried on through agreements with farmers, and the preparation of contracts in this connection is regarded as highly important. There is no part of the work of this Office in which the increasing activity of the other branches of the Department in the line of experiment is reflected more quickly and certainly than in the preparation of agreements.

AGREEMENTS FOR THE SEVERAL BUREAUS, OFFICES, AND DIVISIONS.

Bureau of Plant Industry.—There were 106 contracts, 42 renewals of contracts, 5 letters terminating contracts, 35 leases, 29 renewals of leases, 6 letters terminating leases, and 3 bonds for temporary special disbursing agents, prepared for this Bureau during the fiscal year 1910; this is an increase of 26 contracts, 12 renewals of contracts, 4 leases, and 8 renewals of leases over the fiscal year 1909.

Bureau of Animal Industry.—There were 24 contracts, 13 renewals of contracts, 35 leases, 40 renewals of leases, and 2 letters terminating leases prepared for this Bureau during the fiscal year 1910; this is an increase of 2 contracts, 8 renewals of contracts, and 18 renewals of leases over the fiscal year 1909, and a decrease of 2 leases for the same period.

Weather Bureau.—There were 4 contracts and 6 letters terminating leases prepared for this Bureau, and 15 contracts, 31 leases, and 97 renewals of leases examined during the fiscal year 1910 for this Bureau; this is a decrease of 16 contracts, 1 lease, and 70 contracts, and an increase of 10 renewals of leases, the number of leases examined being the same in the fiscal year 1909 and 1910.

Forest Service.—There were 33 contracts, 16 leases, 5 renewals of leases, and 8 bonds prepared for the Forest Service in Washington during the fiscal year 1910; this is an increase of 33 contracts, 14 leases, 3 renewals of leases, and 8 bonds over the fiscal year 1909. As hereinbefore stated, there were 53 contracts, 57 bonds, and 150 leases prepared for this Bureau by the branches of this Office in the field during the period from January 15, 1910, to June 30, 1910.

Bureau of Chemistry.—There were 10 contracts, 10 leases, 22 renewals of leases, and 8 letters terminating leases prepared for this Bureau during the fiscal year 1910. This is a decrease of 27 contracts and 22 leases and an increase of 7 renewals over the fiscal year 1909.

Office of Experiment Stations.—There were 3 contracts, 4 leases, 7 renewals of leases, and 1 letter terminating a contract prepared for this Bureau during the fiscal year 1910; this is a decrease of 6 leases and an increase of 2 renewals of leases over the fiscal year 1909.

Bureau of Entomology.—There were 14 contracts, 24 leases, 17 renewals of leases, and 1 bond prepared for this Bureau during the fiscal year 1910; this is an increase of 7 contracts, 14 leases, and 12 renewals of leases as compared with the fiscal year 1909.

Office of Public Roads.—There were 1 contract, 1 lease, and 1 bond prepared for this Office during the fiscal year 1910; this is an increase of 1 contract and 1 lease as compared with the fiscal year 1909.

Division of Publications.—There was 1 contract prepared and 1 lease renewed during the fiscal year 1910 for this Division; in the fiscal year 1909, 1 contract was renewed and 1 lease prepared for this Division.

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Building Committee.—One lease was prepared and 1 lease renewed for this committee during the fiscal year 1910; no agreements were prepared for the committee during the fiscal year 1909.

Supply Division.—A bond for the chief of this Division was prepared during the fiscal year 1910.

Supply contracts.—The general supply committee, composed of representatives from all the Government Departments, attended to the preparation of contracts for supplies for this Department, except those for supplies for the Forest Service. For this purpose 34 agreements were prepared by this Office. Apparently this was a decrease of 67 contracts over the fiscal year 1909; this difference has been explained.

Division of Accounts.—One contract was terminated and 17 bonds were prepared for this Division during the fiscal year 1910.

RECAPITULATION OF CONTRACTS AND LEASES.

The following table presents a recapitulation of the contracts and leases prepared for the various bureaus, offices, and divisions of the Department in the fiscal year 1910, as compared with the number prepared in the fiscal year 1909:

Bureau, Division, or Office.	1909.		1910.	
	Contracts.	Leases.	Contracts.	Leases.
Bureau of Plant Industry	80	31	106	35
Bureau of Animal Industry	22	37	24	35
Weather Bureau	20	1	4	0
Forest Service	0	2	[a] 33	[a] 16
Bureau of Chemistry	37	32	10	10
Office of Experiment Stations	3	10	3	4
Bureau of Entomology	7	10	14	24
Office of Public Roads	0	1	1	1
Division of Publications	0	1	1	0
Building Committee	0	0	0	1
Supply Division	0	0	0	0
Division of Accounts [b]	101	0	34	0
Total	270	126	230	126

[a] Contracts for Forest Service in Washington, D. C.

[b] Supply contracts.

Total contracts and leases in 1909	396
Total contracts and leases in 1910	356
Decrease in 1910	40

PATENTS FOR DEPARTMENT EMPLOYEES.

Since this Office has been charged with the duty of preparing and prosecuting patent applications for employees of this Department to be dedicated to the public (act of March 3, 1883; 22 Stat., 625), the work connected therewith has been gradually increasing each year. The scope of the work does not consist merely in the preparation and prosecution of such applications, but this Office is frequently called on to render opinions as to the extent of existing patent rights for the purpose of protecting employees engaged in scientific experiments or other Departmental investigations from infringing legal rights of patentees. Again, the Office is often requested to ascertain if patents have been granted on various devices, mechanisms, etc., or whether certain trade-marks have been issued. In order properly to pass

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on these requests it is frequently necessary to make exhaustive researches in the Patent Office. Accordingly much time and careful consideration are necessarily required to be devoted to this work.

During the present year 9 applications for letters patent were filed; in the previous year 7 such applications were presented for prosecution, making an increase of 2 cases. Of this number 5 patents were allowed and 1 disallowed. During the preceding year 4 patents were allowed and 2 disallowed. The following table shows the details of the patent cases on which action was taken during the fiscal year 1910:

Applications pending and presented for patents which were prosecuted by the Solicitor for Department employees during the fiscal year ended June 30, 1910.

Applicant.	Bureau or Office.	Invention.	Disposition of application.
Q. Q. Bradford	Experiment Stations..	Knife for tapping rubber trees...	Patent granted Oct. 25, 1909.
F. G. Plummer	Forest Service	Improvement in hypsometers...	Patent granted Feb. 1, 1910.
George F. Mitchell	Plant Industry	Shrub and plant trimming machine.	Pending.
C. S. Smith	Forest Service	Improvement in wood impregnation.	Do.
D. M. Rogers	Entomology	Insect-destroying bomb	Interference declared; issue decided in favor of D. M. Rogers and patent granted.
Harry D. Tiemann	Forest Service	Process for regulating and maintaining humidity.	Pending.
Do	do	Process of rapidly drying timber and other moisture-bearing substances.	Patent granted Nov. 6, 1909.
L. R. Maynard and K. E. Parks.	Animal Industry	Milk cans or containers	Disallowed.
Alexander G. McAdie.	Weather Bureau	Plant protector	Patent granted Dec. 29, 1909.
Do	do	Combination thermograph and hydrograph.	Pending.
Harry B. Shaw	Plant Industry	Camera support	Do.
Harry D. Tiemann	Forest Service	Process of drying timber and other moisture-bearing substances.	Do.
Do	do	Process of rapidly drying timber and other moisture-bearing substances.	Do.
Do	do	Apparatus and process for controlling humidity of gases in drying operations.	Do.
L. W. Page and Allerton S. Cushman.	Public Roads	Process for mixing and preparing hydraulic cement concrete.	Do.

COMMITTEE ON PERSONNEL.

It is gratifying to note that the committee on personnel has not been called upon to consider as many cases during the past fiscal year as during the preceding year, only 4 cases coming before it in the fiscal year 1910. One of these cases was dismissed, in another the resignations of two employees were accepted, in a third two employees were dismissed and one employee transferred to other duties; the fourth case was pending at the close of the year. Realizing your earnest desire that the personnel of this Department should be of the highest character, the committee has not spared any pains to go to the bottom of every case brought before it. The fullest opportunity is afforded all parties concerned to present their case, and the testimony is reduced to writing by a stenographer in this Office, who acts as secretary to the committee.

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PUBLICATIONS OF THE OFFICE.

In addition to the 329 notices of judgment, published by authority of section 4 of the food and drugs act, and discussed in detail in another part of this report, the Office issued 17 circulars embodying decisions of the courts construing statutes which are intrusted to the Department for execution. Thirteen of these embodied decisions on cases arising under the twenty-eight hour law, one under the food and drugs act, one on the railroad right of way act, one on the live stock quarantine act, one being a collection of authorities on the subject of judicial notice of Departmental regulations. These circulars are sent, promptly upon issue, to each of the federal judges and United States attorneys.

On October 2, 1909, the Office issued an annotated edition of the twenty-eight hour law. This had been in contemplation for some time. There are few Federal dockets in the country which do not include cases arising under this act, and in view of the fact that over 40 decisions have been rendered upon it by the district and circuit courts, the circuit courts of appeals, and the Supreme Court of the United States, the publication of the volume was felt to be justified.

STATUS OF OFFICE WORK.

The foregoing summary of the work of this Office, while giving as much as can be expressed statistically, does not convey an adequate idea of the volume or character of business transacted or the special knowledge required to dispose of it. No reference has been made to many matters, which have entailed large demands upon our time. I may mention, as a typical instance of this, the work incident to the transfer to the United States of two large tracts of land in Prince George County, Md., where an experimental dairy farm has been established, which was effected at the close of the past fiscal year, the consideration being $25,000. The property was largely encumbered, there were a number of grantors, and the time within which the transfer had to be made was short. This Office cooperated to the fullest extent with the United States attorney and the special attorneys in charge of title work for the Department of Justice, in this matter. The normal growth of existing lines of work, coincident with the increasing activities of the other branches of the Department, would, in itself, have very greatly enlarged the duties of the Office; in addition to this, however, General Order No. 138, placing the legal work of the Forest Service under my immediate direction, has practically doubled the number of employees of the Office as well as the amount of business to be handled. Toward the close of the past fiscal year it became necessary to move the office quarters in order to provide for the additional force. At the present time, with the exception of the main office of the Solicitor, all the offices, including the library, are under one roof. The change has not only provided more desirable quarters, but afforded an excellent opportunity for a complete reorganization of the force, which has been effected.

The morale of the Office is high; the personnel is of the best. The work is current, and extra time is being cheerfully and consistently

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spent in the endeavor to maintain it in that condition. While the present force is sufficient to handle the business of the Office, it is evident that there will be imperative need for additional assistance in the near future.

GENERAL AND SPECIAL ORDERS OF THE SECRETARY OF AGRICULTURE ISSUED DURING THE FISCAL YEAR 1910.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 9, 1909.

SPECIAL ORDER.

To the Chiefs of Bureaus, Divisions, and Offices:

As the general supply committee has prepared contracts for miscellaneous supplies for the Executive Departments, and this Department has supplemented such action by preparing separate contracts for all technical supplies required, it is hereby ordered that in the purchase of supplies for this Department items enumerated in these contracts be selected and used whenever practicable. The law requires competition in the purchase of supplies, and because an article which is personally preferred by an employee differs slightly from articles of the same class under contract is not a sufficient reason why a purchase should not be made under contract rather than in open market. Open market purchases should be made only when necessary to prevent the work of the Department from being crippled or for the purpose of continuing systems of book cases, filing cases, or other furniture already installed in an office.

With the view of securing the greatest possible economy in all expenditures, in compliance with the express order of the President, no furniture or apparatus should be purchased except such as may be absolutely necessary to replace unserviceable articles of similar character or to equip new offices.

JAMES WILSON,
Secretary.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., November 29, 1909.

CIRCULAR LETTER.

To all Chiefs of Bureaus, Offices, Divisions, and Services and to all their subordinates in the Department of Agriculture:

The President of the United States has issued an order, of which the following is a copy:

EXECUTIVE ORDER.

"It is hereby ordered that no bureau, office, or division chief, or subordinate in any department of the Government, and no officer of the army or navy or marine corps stationed in Washington, shall apply to either House of Congress, or to any committee of either House of Congress, or to any member of Congress, for legislation, or for appropriations, or for congressional action of any kind, except with the consent and knowledge of the head of the department; nor shall any such person respond to any request for information from either House of Congress, or any committee of either House of Congress, or any member of Congress, except through, or as authorized by, the head of his department.

"WM. H. TAFT.

"THE WHITE HOUSE,
"*November 26, 1909.*

'(No. 1142.)"

Your close attention to and strict observance of the above executive order is hereby enjoined upon each and every one in the Department of Agriculture.

JAMES WILSON,
Secretary of Agriculture.

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DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 1, 1909.

GENERAL ORDER No. 137.

RELATING TO NON-OBSERVANCE OF CURRENT FISCAL REGULATION No. 45.

The attention of all employees of this Department who in performance of their official duties are authorized to use the commercial telegraph service is directed to the following extracts from fiscal regulation No. 45:

"The telegraph should be used sparingly."

"And only when the delay in using the mail would be injurious to the public interests."

"*Omit all unnecessary words.*"

"In a message from one official or employee to another *titles should not be used.*"

"In a great many cases *names in both address and signature may be limited to single words.*"

"*Numbers* should be *expressed in words.*"

"*Ordinal numbers must not be abbreviated.*"

Inattention to the foregoing simple rules is widespread, and general failure to adhere to them substantially increases the telegraph bill of the Department.

Negligent disregard of the provisions of this important regulation must cease, and it is hereby ordered that on and after January 1, 1910, the disbursing clerk of the Department shall report those who ignore the above rules to the chiefs of their respective Bureaus, Offices, and Divisions, who shall take such action in each case as will cause future strict observance of the regulation.

JAMES WILSON,
Secretary.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1910.

GENERAL ORDER No. 138:

The legal work of the Forest Service will be performed under the immediate supervision and direction of the Solicitor for the Department of Agriculture.

The disbursing and accounting work of the Forest Service will be performed under the immediate supervision and direction of the Chief of the Division of Accounts and Disbursements, who is by statute the administrative officer of fiscal affairs of the Department of Agriculture. The Chief of the Division of Accounts and Disbursements may, subject to the approval of the Secretary of Agriculture, make such changes in methods of accounting and disbursing in the Forest Service as he shall deem necessary from time to time, and in all matters pertaining to accounts and disbursements the fiscal agents of the Forest Service will be governed by his instructions.

The publicity work of the Department will, in every detail, be approved by the Chief of the Bureau, Office, or Division interested, and be submitted to the Secretary of Agriculture before publication.

This order shall take effect at once, and all orders in conflict herewith are hereby revoked.

JAMES WILSON,
Secretary of Agriculture.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., March 7, 1910.

CIRCULAR LETTER.

To the officers and employees of the Department of Agriculture respecting leaves of absence and furloughs without pay:

A leave of absence without pay is only granted to a person employed in some Bureau, Office, Division, or Service of the Department of Agriculture, when such person makes a written request for such leave, stating the reason therefor and the length of time the applicant desires such absence to continue, which shall not conflict with General Order No. 100, and such leaves of absence are granted only by the Secretary of Agriculture on the recommendation of the applicant's chief.

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A furlough without pay is ordered when the services of the person furloughed are temporarily discontinued in the Department for the good of the service or because of the needs of the Department, and then only in accordance with General Order No. 100, as follows:

"UNITED STATES DEPARTMENT OF AGRICULTURE,
"OFFICE OF THE SECRETARY,
"*Washington, D. C., July 27, 1906.*

"GENERAL ORDER No. 100.

"In the United States Department of Agriculture no leave of absence without pay will hereafter be granted for a longer period than three months, except in special and peculiar cases, and no furlough without pay or leave of absence without pay shall continue in force and effect for a longer period than one year from the date of the commencement thereof."

JAMES WILSON,
Secretary of Agriculture.

S. R. BURCH,
Chief Clerk.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., April 4, 1910.

GENERAL ORDER No. 139.

All Department employees are hereby directed to return to the Department Library all books and periodicals belonging to or borrowed through the Library, before leaving the city for a period of more than two weeks. In case certain books are needed for use by others in the same office, they must be charged to some one who will be responsible for them. Also, when leaving for a period of less than two weeks, employees having books charged to them must place them in the care of some one who will be responsible for them and who will be able to return the books if they are needed. *In no case must books be left at home or in locked desks at the Department.*

JAMES WILSON,
Secretary of Agriculture.

F. G. KELSEY,
Acting Chief Clerk.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 9, 1910.

GENERAL ORDER No. 140.

DUTIES OF THE SOLICITOR.

The act of Congress approved May 26, 1910, contains the following provision:

"Hereafter the legal work of the Department of Agriculture shall be performed under the supervision and direction of the Solicitor."

To carry into effect this provision of law it is hereby ordered that the legal work of the various bureaus, offices, and divisions of this Department shall hereafter be conducted as follows:

1. WEATHER BUREAU.—The legal work of the Weather Bureau, including all matters on which legal advice is necessary, shall be referred to the Solicitor. Telephone and telegraph contracts, leases, and renewals of leases, contracts for the erection of buildings, and all other legal agreements will be prepared by the Solicitor upon request from the Chief of the Weather Bureau.

2. BUREAU OF ANIMAL INDUSTRY.—The legal work of the Bureau of Animal Industry, including the drafting of agreements and all other matters on which legal advice is necessary, shall be referred to the Solicitor. All alleged violations of the animal quarantine laws, the meat-inspection law, and the twenty-eight hour law will be referred to the Solicitor to determine the action to be taken by the Department of Agriculture. No recommendation relative to the legal side of any case arising under the quarantine laws, the meat-inspection law, or the twenty-eight hour law shall be made to any officer of the Department of Justice, nor shall communications, oral or written, be addressed to any officer of the Executive Departments regarding

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matters arising in connection with acts of Congress with which this Department is concerned, except with the approval of the Solicitor, obtained in advance.

3. BUREAU OF PLANT INDUSTRY.—The legal work of the Bureau of Plant Industry, including the drafting of agreements and all other matters on which legal advice is necessary, shall be referred to the Solicitor.

4. FOREST SERVICE.—The legal work of the Forest Service shall be conducted in accordance with General Order No. 138, dated January 15, 1910, subject to the following change: On and after July 1, 1910, the positions of law officer, first assistant law officer, and assistant law officer, in Washington, will be discontinued, and the law work of the Forest Service, in Washington, will be performed under the immediate direction of the Solicitor.

5. BUREAU OF CHEMISTRY.—The legal work of the Bureau of Chemistry, including the drafting of agreements and all other matters on which legal advice is necessary, shall be referred to the Solicitor. In accordance with section 4 of the food and drugs act of June 30, 1906 (34 Stats., 768), the examination of foods and drugs, in connection with the enforcement of the act, shall be made in the Bureau of Chemistry. After such examinations, all the evidence in all cases, with such summaries to be prepared by the Bureau of Chemistry as the Solicitor shall prescribe, shall be referred to the Solicitor to determine whether a prima facie case has been made and to recommend to the Secretary whether citation to a hearing shall issue. In all cases where citations issue the Solicitor will prescribe the form and manner of issuing and the parties to whom citations shall issue. Hearings will be held by or under the supervision of the Board of Food and Drug Inspection, as heretofore. In every instance, after a hearing has been held or an opportunity for a hearing afforded, the case, including all papers in reference thereto, together with such summaries as the Bureau of Chemistry shall prepare at the direction of the Solicitor, shall be submitted to the Solicitor for recommendation to the Secretary as to whether the case shall be reported to the Department of Justice for prosecution. The Board of Food and Drug Inspection will submit to the Solicitor, for recommendation to the Secretary, all proposed seizures to be effected under section 10 of the food and drugs act. The Board shall also submit to the Solicitor all the evidence in its possession at the time seizures are proposed, and shall report to him promptly all facts which may develop subsequently in regard thereto. The Solicitor will continue, as heretofore, to prepare the notices of judgment authorized under section 4 of the statute, and will have general supervision of the preparation of all Food Inspection Decisions issued from time to time. No recommendation relative to the legal side of any case arising under the food and drugs act shall be made to any officer of the Department of Justice, nor shall communications, oral or written, be addressed to any officer of the Executive Departments regarding matters arising in connection with acts of Congress with which this Department is concerned, except with the approval of the Solicitor, obtained in advance.

6. BUREAU OF SOILS, BUREAU OF ENTOMOLOGY, BUREAU OF BIOLOGICAL SURVEY.—The legal work of these bureaus, including the drafting of agreements and all other matters on which legal advice is necessary, shall be referred to the Solicitor.

7. DIVISION OF ACCOUNTS.—The legal work of the Division of Accounts, including all matters on which legal advice is necessary, shall be referred to the Solicitor, including the preparation of requests for the signature of the Chief of the Division of Accounts upon the Comptroller of the Treasury, for his opinion.

8. DIVISION OF PUBLICATIONS, BUREAU OF STATISTICS, LIBRARY, OFFICE OF EXPERIMENT STATIONS, and OFFICE OF PUBLIC ROADS.—The legal work of these bureaus and offices, including the drafting of agreements and all matters on which legal advice is necessary, shall be referred to the Solicitor.

Compilations of laws in which the Department is interested will be prepared under the direction of the Solicitor, when requested by a chief of bureau and ordered by the Secretary. All requests for authorization of any Department officers or employees to travel for the purpose of attending court proceedings as witnesses, or to confer with officers of the Department of Justice concerning the preparation of cases for trial, as well as accounts rendered for expenses incurred under such authorizations, shall be submitted to the Solicitor for his approval. Arrangements for the employment of necessary witnesses not connected with the Department shall also be made with his approval.

This order shall take effect July 1, 1910. It supplements General Order No. 85, dated June 17, 1905, which is continued in full force and effect.

JAMES WILSON,
Secretary of Agriculture.

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DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 21, 1910.

GENERAL ORDER No. 141.

Hereafter no expenses other than for salaries will be allowed subordinate employees of the Department of Agriculture while in attendance, at their own request, upon any conventions or meetings of associations of any kind.

Special order of June 17, 1907, is amended accordingly.

JAMES WILSON, *Secretary.*

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 28, 1910.

SPECIAL ORDER.

In pursuance of the authority conferred on me by executive order of June 25, 1909, in regard to limitation of hours of work on Saturdays in July, August, and September, it is hereby ordered that as to the Forest Service the said limitation of hours of work shall apply only to employees in the District of Columbia and those employees engaged elsewhere in office work in cities, towns, or forest supervisors' offices, and shall not apply to other employees of that service in the field.

JAMES WILSON, *Secretary.*

Attest:
S. R. BURCH,
Chief Clerk.

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REPORT OF THE APPOINTMENT CLERK.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE APPOINTMENT CLERK,
Washington, D. C., September 22, 1910.

SIR: I have the honor to submit herewith my annual report respecting appointments, promotions, reductions, removals, and other changes among the working force of the entire United States Department of Agriculture during the fiscal year ended June 30, 1910, and also containing matters respecting the officers and employees in the several offices, bureaus, and divisions constituting the body of the Department of Agriculture as it existed on July 1, 1910.

Very respectfully,

J. B. BENNETT,
Appointment Clerk.

Hon. JAMES WILSON,
Secretary of Agriculture.

CHANGES IN THE FORCE OF THE DEPARTMENT

Summary of appointments, promotions, removals, etc., in the United States Department of Agriculture during the fiscal year ended June 30, 1910, and as reported to the United States Civil Service Commission.

IN THE CLASSIFIED SERVICE.

Number of persons appointed from the eligible registers of the Civil Service Commission for a probationary period of six months, equivalent to absolute appointment if retained in the service at the termination of the said probationary period	1,088
Number of persons who have been reinstated in the service of the Department within one year after having resigned or having been separated therefrom	56
Number of persons transferred from other Departments of the United States Government to the United States Department of Agriculture	67
Number of persons promoted in salary	2,340
Number of persons reduced in salary	79
Number of temporary or emergency appointments certified for appointment, or authorized by the Civil Service Commission to be appointed in the classified civil service, in accordance with civil-service rules, for periods of six months or less, and who are separated from the service when the emergency that caused their appointments has ended	727
Number of temporary or emergency appointments in the classified civil service, in accordance with civil-service rules, for periods of six months or less, conditioned as above, in the forests and fields and on stations in the various States outside of Washington, D. C.	3,128
Number of persons who declined to accept appointments in the Department	63
Number of persons who resigned their positions in the Department	681
Number of persons who were removed from the service of the Department because of their misconduct	75
Number of persons who died while in the service of the Department	61

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IN SPECIAL POSITIONS EXCEPTED FROM EXAMINATION UNDER CIVIL-SERVICE RULES.

Number of persons appointed to positions which are in the classified civil service, but which are excepted from civil-service examination according to civil-service rules, the appointments being for very temporary periods and including those for service in Washington, D. C., and those for service outside of Washington, D. C.	2,178
Number of persons employed in positions which are in the classified civil service, but which are excepted from civil-service examination according to civil-service rules, the employments being for very temporary periods and for service in the forests and fields or on stations in the various States outside of Washington, D. C., as reported in monthly reports to the Secretary of Agriculture by the several Bureaus and the Forest Service of the Department and approved by the Secretary	1,556

IN THE UNCLASSIFIED SERVICE (POSITIONS OF MERE MANUAL LABORER).

Appointments in the District of Columbia	39
Promotions in salary in the District of Columbia	21
Reductions in salary in the District of Columbia	0
Separations from the service in the District of Columbia	22
Number of persons appointed in the forests and fields and on stations in the various States outside of Washington, D. C., being in the manual-laborer grade, the appointments being for very short periods, usually averaging not more than three months	19,494
Number of temporary or emergency appointments in the manual-laborer grade in the District of Columbia	122

TOTAL NUMBER OF APPOINTMENTS OF EVERY DESCRIPTION.

Total number of appointments of every description, including those for service in Washington, D. C., and those for service outisde of Washington, D. C., in cattle and meat inspection, on forest reserves, on experiment stations and experiment farms, in moth and cotton boll weevil extermination, etc., many of which were of a temporary character and for a limited period	34,267

DEATHS IN THE DEPARTMENT.

During the fiscal year ended June 30, 1910, there were recorded 61 deaths among the officers and employees of the entire United States Department of Agriculture, 22 of persons stationed in Washington, D. C., and 39 of persons stationed outside of Washington, D. C., as shown in the following table:

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Deaths in the Department during the fiscal year ended June 30, 1910.

[Those marked * were stationed in Washington, D. C.; those marked † were stationed outside of Washington, D. C.]

Name.	State.	Position.	Bureau, division, or office.	Salary per annum.	Date of death.	Age.
					1909.	
*Frank M. Ford	N. Y.	Skilled laborer	Division Publications.	$720	July 10	26
*Mary L. McDonald	D. C.	Charwoman	Forest Service	240	July 14	37
†Willard W. Clark	N. Y.	Forest supervisor	do	2,000	July 20	30
†Jesse L. Johnson	Ala.	Collaborator	Plant industry	a 1	do	26
†Andrew J. Kent	do	Special agent	do	b 75	July 27	32
†Robert McNaughton	Kans.	Meat inspector	Animal Industry	1,000	July 28	43
*May H. Wright	Ky.	Clerk	Division Publications.	840	do	49
*William H. Ragan	Ind.	Expert in pomological nomenclature.	Plant Industry	1,600	Aug. 6	73
†Jacob C. Brobeck	Ohio	Veterinary inspector	Animal Industry	1,400	Aug. 7	32
*Michael Long	Mass.	Messenger	Division Publications.	600	Aug. 10	73
†William P. Cherrington.	do	Stock examiner	Animal Industry	1,200	Aug. 12	74
*Charles H. Pilcher	Va.	Engineer	Weather Bureau	1,200	Aug. 15	45
†Theodore F. Cadle	Oreg.	Assistant forest ranger	Forest Service	900	Sept. 1	34
†Michael Justinger	N. Y.	Skilled laborer	Animal Industry	720	Sept. 7	51
†George H. Schroeder	Nebr.	Inspector's assistant	do	1,000	do	63
*David O. Moise	La.	Assistant messenger	Office Secretary	720	Sept. 12	21
†Frank H. Herlinger	Mo.	Stock examiner	Animal Industry	1,000	Sept. 14	37
*Carl W. Sweeny	Va.	Unskilled laborer	Plant Industry	a 1⅔	Oct. 1	27
†Henry J. Egan	Iowa.	Meat inspector	Animal Industry	1,000	Oct. 2	43
*Plato T. Lee	D. C.	Skilled laborer	Weather Bureau	450	Oct. 26	73
†Matthew Robinson	Penn.	Stock examiner	Animal Industry	1,000	do	63
†Edward Romey	Wyo.	Assistant forest ranger	Forest Service	900	Oct. 29	39
*Henry C. Towers	D. C.	Expert and chief of the Section of Purchase.	do	1,500	Oct. 30	60
†William A. Phelps	N. M.	Forest ranger	do	1,300	Nov. 2	35
†Henry F. Potratz	Ill.	Veterinary inspector	Animal Industry	1,600	Dec. 18	29
†Thomas M. Smith	Ind.	Skilled laborer	do	900	do	70
†James M. Watson	Ill.	Observer	Weather Bureau	1,200	do	60
†Carl W. Gleason	Wyo.	Deputy forest ranger	Forest Service	1,100	Dec. 26	31
†Gustave A. Schell	Okla.	Meat inspector	Animal Industry	1,000	Dec. 30	47
					1910.	
†John B. Sine	Ill.	Special stock examiner	Animal Industry	1,200	Jan. 1	70
†Joseph P. Coffy	N. Y.	Veterinary inspector	do	1,400	Jan. 4	30
†William R. McKinnon	Minn.	Lumberman	Forest Service	1,600	do	33
†John H. Garber	Iowa.	Food and drug inspector	Chemistry	2,000	Feb. 5	43
*James K. Kerr, sr	D. C.	Gardener	Plant Industry	1,100	do	79
†Lewis I. Palmer	Okla.	Veterinary inspector	Animal Industry	1,400	Feb. 8	43
†George W. Scott	Wyo.	Observer	Weather Bureau	1,200	do	55
*Sadie A. George	D. C.	Unskilled laborer	Chemistry	480	Feb. 18	44
†Linus S. A. Fenstermacher.	N. J.	Stock examiner	Animal Industry	1,000	Feb. 22	29
*Anne E. Fowler	Md.	Draftsman	Forest Service	1,000	Feb. 25	40
†Patrick E. Canty	Iowa.	Meat inspector	Animal Industry	1,000	Feb. 26	34
*Thomas B. Reamy	Va.	Messenger	do	840	Mar. 1	74
*Charles F. Wheeler	Mich.	Expert	Plant Industry	2,000	Mar. 5	67
*Thomas A. Caine	N. Y.	Scientist in Soil Survey	Soils	1,800	Mar. 11	37
*Edmund Burke	Penn.	Clerk	Plant Industry	900	Mar. 17	67
†Douglas H. Clemons	N. Y.	Entomological assistant	Entomology	b 75	Mar. 22	21
†Osmer W. Shaner	Oreg.	Assistant forest ranger	Forest Service	1,100	Mar. 24	38
*James R. Cook	D. C.	Clerk	Weather Bureau	1,200	Apr. 2	78
*Louis C. Summer	Ohio	do	Animal Industry	1,200	Apr. 4	43
†Oliver R. Moyer	Iowa.	Veterinary inspector	do	1,400	Apr. 24	53
†James R. Thompson	Ga.	Inspector's assistant	do	720	May 3	26
†Archibald H. Wallace	N. J.	Veterinary inspector	do	2,000	May 6	34
†Alexander A. Cummings.	Minn.	Forest guard	Forest Service	900	May 8	26
†William R. Dodds	Utah.	do	do	1,100	do	31
*Edward B. Garriott	Ill.	Professor meteorology	Weather Bureau	3,000	May 13	57
†Henry C. Hinst	Idaho.	Deputy forest ranger	Forest Service	1,100	May 17	42
*John D. Palm	Penn.	Clerk	Weather Bureau	900	May 24	33
*Conrad E. Hesse	do	do	do	1,200	May 30	42
†Frank P. Hill	Oreg.	Assistant forest ranger	Forest Service	1,100	May 31	23
†Thomas Bell	Okla.	Clerk-typewriter	Animal Industry	900	June 4	27
†Robert A. Duncan	Hawaii	Food and drug inspection chemist.	Chemistry	1,500	June 9	35
†Sidney E. Moylle	Colo.	Assistant forest ranger	Forest Service	1,100	June 15	32

a Per diem. b Per month.

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ESTABLISHMENT AND GROWTH OF THE DEPARTMENT OF AGRICULTURE.

The Department of Agriculture was established July 1, 1862, according to the provisions of an act approved May 15, 1862 (Stat. L., vol. 12, chap. 72, pp. 387, 388).

Growth of the force of the Department from September 30, 1863, to July 1, 1910.

Date.	Number employed.	Date.	Number employed.
1863, September 30	29	1897, July 1	2,444
1867, September 30	99	1899, July 1	2,965
1871, September 30	84	1900, November 16	3,128
1873, September 30	92	1901, July 1	3,388
1875, September 30	90	1902, July 1	3,789
1877, September 30	77	1903, July 1	4,200
1879, June 30	93	1904, July 1	4,504
1881, July 1	108	1905, July 1	5,446
1883, July 1	239	1906, July 1	6,242
1885, July 1	214	1907, July 1	9,107
1887, July 1	328	1908, July 1	10,420
1889, July 1	488	1909, March 4	10,280
1891, July 1[a]	1,577	1909, July 1	11,140
1893, July 1	1,870	1910, July 1	12,480
1895, July 1	2,043		

[a] The large increase on July 1, 1891, resulted from the transfer of the Weather Bureau to the Department of Agriculture on that date.

The following statements show the number and the increase in the number of persons employed in the various bureaus, divisions, offices, and the Forest Service of the United States Department of Agriculture.

OFFICE OF THE SECRETARY.

Total force on the rolls on July 1, 1909 155
Total force on the rolls on July 1, 1910 212

Classification and number of persons in the Office of the Secretary on July 1, 1910.

Classification.	Number.	Classification.	Number.
Secretary of Agriculture	1	Electrician	1
Assistant Secretary of Agriculture	1	Electric wireman	1
Solicitor	1	Elevator conductors	4
Chief clerk and custodian of buildings	1	Messengers	3
Private secretary to the Secretary of Agriculture	1	Assistant messengers	3
Stenographer and executive clerk to Secretary	1	Messenger boys	2
Private secretary to the Assistant Secretary of Agriculture	1	Construction inspector	1
Stenographer to the Assistant Secretary of Agriculture	1	Cabinetmakers	4
Appointment clerk	1	Carpenters	12
Chief of Supply Division	1	Painters	4
Inspector	1	Mechanics	4
Law clerks	21	Blacksmith	1
Telegraph and telephone operator	1	Plumbers	3
Clerks	37	Plumber's helpers	2
Chief engineer and captain of the watch	1	Skilled laborers	13
Engineer	1	Manual laborers	28
Assistant engineers	3	Charwomen	14
Firemen	7	Lieutenant of watch	1
		Watchmen	29
		Total	212

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WEATHER BUREAU.

Total force on the rolls on July 1, 1909..... 1,825
Total force on the rolls on July 1, 1910..... 2,017

Classification and number of persons in the Weather Bureau on July 1, 1910.

Classification.	Number.	Classification.	Number.
Chief of the Weather Bureau	1	Student assistants	6
Assistant Chief of the Weather Bureau	1	Operator	1
Chief clerk	1	Assistant foremen of divisions	2
Professors of meteorology	9	Proofreader	1
Inspectors	2	Lithographers	4
Chiefs of divisions	5	Compositors	13
District forecasters	8	Printers	25
Local forecasters	75	Pressmen	2
Section directors	40	Folders and feeders	9
Research director	1	Chief mechanic	1
Research observer	1	Skilled mechanics	10
Observers	91	Skilled artisans	6
Assistant observers	214	Electrician	1
Evaporation observers	2	Engineer	1
Special observer	1	Firemen	5
Special meteorological observers	73	Repairmen	10
Cotton region observers	117	Carpenter	1
Sugar and rice region observers	7	Gardener	1
Corn and wheat region observers	130	Skilled laborers	5
Cranberry marsh observers	4	Classified, unclassified, and unskilled laborers	13
Mountain snowfall observers	336	Captain of the watch	1
Special rainfall observers	31	Watchmen	4
Special river observers	325	Charwomen	4
Storm warning displaymen	183	Messengers	82
Expert in vessel reporting	1	Messenger boys	106
Station agents	2		
Librarian	1	Total	2,017
Clerks	86		
Copyists	5		

BUREAU OF ANIMAL INDUSTRY.

Total force on the rolls on July 1, 1909..... 3,268
Total force on the rolls on July 1, 1910..... 3,175

Classification and number of persons in the Bureau of Animal Industry on July 1, 1910.

Classification.	Number.	Classification.	Number.
Chief of Bureau	1	Veterinary inspectors	926
Assistant Chief of Bureau	1	Meat inspectors	944
Chief clerk	1	Vessel inspectors	4
Chief of Biochemic Division	1	Inspector's assistants	392
Chief of Pathological Division	1	Special experts	26
Chief of Inspection Division	1	Special agents	11
Chief of Quarantine Division	1	Collaborators	7
Chief of Zoological Division	1	Agents in scabies eradication	67
Chief of Dairy Division	1	Agents in tick eradication	70
Chief of Animal Husbandry Division	1	Illustrator	1
Associate chiefs of Inspection Division	3	Editor and compiler	1
Superintendent of experiment station	1	Clerks, stenographers and typewriters	20
Assistant to superintendent of experiment station	1	Clerks	192
Dairy inspector	1	Architects	3
Dairymen	44	Carpenters	3
Live-stock inspectors	4	Plumbers	5
Field stock examiners	5	Painters	2
Stock examiners	214	Cabinetmakers	4
Laboratory inspectors	20	Instrument maker	1
Laboratory helpers	7	Skilled laborers	51
Biochemists	4	Manual laborers	62
Bacteriologists and Physiologists	9	Messengers	9
Zoologists	5	Messenger boys	8
Scientific assistants	6	Charwomen	15
Microscopists	3	Watchman	1
Animal husbandmen	13	Total	3,175

NOTE.—There are 180 stations in the Bureau of Animal Industry outside of Washington, D. C., in which work appertaining to that Bureau is done.

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BUREAU OF PLANT INDUSTRY.

Total force on the rolls on July 1, 1909..... 1,211
Total force on the rolls on July 1, 1910..... 1,472

Classification and number of persons in the Bureau of Plant Industry on July 1, 1910.

Classification.	Number.	Classification.	Number.
Plant Physiologist and Pathologist and Chief of Bureau	1	Assistants in sugar-beet investigations	2
Pomologist and Assistant Chief of Bureau	1	Special assistants in various lines of scientific agriculture	16
Consulting physiologist and pathologist	1	Scientific assistants	67
Chief clerk	1	Student assistants	6
Executive clerks	3	Chemist's aids, laboratory aids, laboratory assistants, and laboratory helpers	29
Executive assistants	2	Horticulturist in charge of Arlington farm	1
Physiologists in charge of various sections of the Bureau	4	Assistant horticulturist	1
Physiologists, plant physiologists, and assistant physiologists	18	Viticultural superintendent	1
Pathologists in charge of various sections of the Bureau	4	Superintendent of testing gardens	1
Pathologists, plant pathologists, and assistant pathologists	12	Assistant superintendent of testing gardens	1
Botanists in charge of the various sections of the Bureau	3	Superintendent of gardens and grounds	1
Botanists and assistant botanists	8	Gardeners	35
Chemical biologists	5	Greenhouse assistants	2
Micologists	2	Superintendent of the section of seed weighing and mailing	1
Bionomist	1	Assistant superintendent of the section seed weighing and mailing	1
Pomologists in charge of sections of the Bureau	2	Inspector of seed warehouse	1
Pomologists	3	Assistant in charge of plant houses	1
Physicist in charge of physical investigations	1	Forest assistant	1
Assistant physicist	1	Curator	1
Cerealist in charge of cereal investigations	1	Officer in charge of records	1
Agriculturist in charge of dry-land agricultural investigations	1	Library assistant	1
Assistant in dry-land agriculture	1	Map tracer	1
Agriculturist in charge of western agricultural extension	1	Artists	2
Agricultural explorers	2	Photographers	2
Assistant in farm management	1	Editor	1
Agriculturist in charge of farm management	1	Clerks[a]	189
Agriculturists in various special lines of agriculture	18	Experts	49
Agrostologists	5	Agents	318
Agronomists and assistant agronomists	6	Special agent in charge of farmers' cooperative demonstration work	1
Fence rider	1	Collaborators	355
Farm superintendents	3	Mechanicians	4
Agricultural technologists	1	Carpenters	3
Crop technologists	5	Plumber	1
Crop technologist assistants and aids	19	Painter	1
Arboriculturist	1	Skilled laborers	33
Assistants in arboriculture	6	Unskilled laborers	161
		Messengers	9
		Messenger boys	15
		Charwomen	10
		Total	1,472

[a] Three-fourths of these clerks are also stenographers and typewriters.

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FOREST SERVICE.

Total force on the rolls on July 1, 1909..... 2,881
Total force on the rolls on July 1, 1910..... 3,636

Classification and number of persons in the Forest Service on July 1, 1910.

Classification.	Number.	Classification.	Number.
Forester	1	Forest assistants	170
Associate Forester	1	Grazing assistants	2
Assistant foresters	8	Game wardens	2
District foresters	6	Rodman	1
Associate district foresters	5	Field assistants	90
Assistant district foresters	38	Scientific assistant	1
Chief of branch of lands	1	Forest guards	723
Chiefs of maintenance	5	Lumbermen	15
Chief lumberman	1	Scalers	5
Chief of publications	1	Laboratory assistants	8
Chief of silvics	1	Superintendent of telegraph construction	1
Chief of state and private cooperation	1	Law examiners	7
Chief of distribution	1	Law clerk	1
Chief of section of wood technology	1	Land law clerks	7
Chief of timber tests	1	Clerks, stenographers, and typewriters	96
Chief of wood utilization	1	Forest clerks	123
Chief of the office of records	1	Clerks	236
Chief of planting	1	Telegraph and telephone operator	1
Assistant chiefs	2	Compiler	1
Assistant director	1	Property auditor	1
General inspector	1	Negative cutter	1
Inspector of grazing	1	Map colorists	10
Assistant inspector	1	Timber cruiser	1
Plant ecologists	4	Experts of various classes	44
Chemist in forest products	1	Agents of various classes	17
Topographer	1	Collaborators	5
Artists	2	Forest students	2
Lithographers	2	Machinist	1
Photographers	4	Electrician	1
Geographer	1	Carpenters	4
Engineers in timber tests	12	Sawyer	1
Assistant in timber tests	1	Skilled laborers	5
Engineers in wood preservation	9	Apprentice	1
Constructing civil engineer	1	Messengers	22
Constructing engineers	3	Messenger boys	16
District engineer	1	Manual laborers	16
Surveyors	4	Charwomen	14
Draftsmen	33	Watchmen	4
Forest supervisors	137	Temporary fire fighters, clerks, carpenters, planters, laborers, cooks, trailers, chainmen, teamsters, brush burners, etc., employed on the National Forests on July 1, 1910	175
Deputy forest supervisors	108		
Forest examiners	14		
Forest rangers	256		
Deputy forest rangers	64		
Assistant forest rangers	1,058		
Forest planting assistants	8	Total	3,636

NOTE.—On June 30, 1910, there were 149 National Forests under the control and supervision of the Forest Service, which contained an area of 192,931,197 acres.

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BUREAU OF CHEMISTRY.

Total force on the rolls on July 1, 1909..... 475
Total force on the rolls on July 1, 1910..... 502

Classification and number of persons in the Bureau of Chemistry on July 1, 1910.

Classification.	Number.	Classification.	Number.
Chemist and Chief of Bureau	1	Artist	1
Chemist and Assistant Chief of Bureau	1	Tool maker	1
Associate chemist and member of the Board of Food and Drug Inspection	1	Skilled mechanic	1
Chemists, chiefs of divisions	2	Skilled laborer	1
Chiefs of laboratories	27	Manual laborers	12
Chief inspector	1	Elevator conductor	1
Physiological chemists	2	Messengers	10
Bacteriological chemists	3	Janitors	2
Organic chemists	3	Property custodian	1
Food and drug inspection chemists	20	Charwomen	5
Food inspection chemists	5	Total	466
Fermentation chemists	2	REFEREE BOARD AND ASSISTANTS.	
Assistant chemists	113		
Collaborating chemists	24	Board of consulting scientific experts to aid the Secretary of Agriculture in enforcing the food and drugs act of June 30, 1906	5
Assistant bacteriologists	2	Expert assistants	21
Pharmacologist	1	Agents, collaborating subjects for experimentation	6
Pharmacognosists	2	Stenographer	1
Microanalysts	4	Agent	1
Food and drug inspectors	39	Total	34
Drug inspector	1		
Scientific assistants	15	Total in Bureau of Chemistry	502
Special agents	7		
Special experts	14		
Special laboratory assistants	3		
Laboratory helpers	54		
Chief clerk	1		
Clerks	58		
Stenographers and typewriters	27		

BUREAU OF SOILS.

Total force on the rolls on July 1, 1909..... 142
Total force on the rolls on July 1, 1910..... 136

Classification and number of persons in the Bureau of Soils on July 1, 1910.

Classification.	Number.	Classification.	Number.
Soil Physicist and Chief of Bureau	1	Special agent	1
Chief clerk	1	Publicity agent	1
Soil scientists	67	Special field agents	7
Soil bibliographers	3	Collaborators	20
Clerks	22	Messenger	1
Copyist topographic draftsman	1	Messenger boy	1
Draftsmen	2	Laborers	4
Laboratory aid	1	Charwoman	1
Photographer	1	Total	136
Expert in soil erosion and sedimentation	1		

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BUREAU OF ENTOMOLOGY.

Total force on the rolls on July 1, 1909..... 437
Total force on the rolls on July 1, 1910..... 542

Classification and number of persons in the Bureau of Entomology on July 1, 1910.

Classification.	Number.	Classification.	Number.
Entomologist and Chief of Bureau	1	Entomological preparators	9
Entomologist and Acting Chief of Bureau in the absence of the chief	1	Apicultural assistant	1
Entomologist in charge of truck crop and stored product insect investigations	1	Artist	1
Agent and expert in charge of forest insect investigations	1	Scientific assistants	2
Expert in charge of apicultural investigations	1	Student assistants	3
Agent and expert in charge of deciduous fruit insect investigations	1	Clerks	24
Agent and expert in charge of cereal forage insect investigations	1	Agents and experts	54
Agent and expert in charge of southern field crop insect investigations	1	Experts	2
Expert in charge of breeding experiments	1	Agents	9
Executive assistant	1	Collaborators	10
Chief clerk	1	Messengers	2
Entomological assistants	23	Charwomen	3
Entomological draftsman	1	Miscellaneous laborers	9
		Spray foremen	7
		General foremen	3
		Foremen	41
		Toolkeeper	1
		Scouts	32
		Laborers	294
		Total	542

BUREAU OF BIOLOGICAL SURVEY.

Total force on the rolls on July 1, 1909..... 54
Total force on the rolls on July 1, 1910..... 68

Classification and number of persons in the Bureau of Biological Survey on July 1, 1910.

Classification.	Number.	Classification.	Number.
Biologist and Chief of Bureau	1	Biological experts	5
Assistant Chief of Bureau	1	Bird migration expert	1
Consulting biologist	1	Expert taxidermist	1
Assistant in charge of biological investigations	1	Map draftsman and colorist	1
Assistant in charge of economic investigations	1	Photographer	1
Assistant in charge of economic ornithology	1	Clerks	9
Assistant biologists	7	Agents	4
Assistant ornithologist	1	Inspectors	8
Scientific assistant in biology	1	Game wardens	16
Chief field naturalist	1	Messenger	1
Expert field naturalists	3	Laborers	2
		Total	68

DIVISION OF ACCOUNTS AND DISBURSEMENTS.

Total force on the rolls on July 1, 1909..... 41
Total force on the rolls on July 1, 1910..... 53

Classification and number of persons in the Division of Accounts and Disbursements on July 1, 1910.

Classification.	Number.	Classification.	Number.
Chief of Division and Disbursing Clerk	1	Auditors	2
Assistant Chief of Division	1	Clerks	37
Chief of office of accounts and fiscal agent	1	Custodian of records and files	1
Cashier and chief clerk	1	Messenger	1
District fiscal agents	8	Total	53

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DIVISION OF PUBLICATIONS.

Total force on the rolls on July 1, 1909 193
Total force on the rolls on July 1, 1910 192

Classification and number of persons in the Division of Publications on July 1, 1910.

Classification.	Number.	Classification.	Number.
Editor and Chief of Division	1	Forewomen	2
Editor and Assistant Chief of Division	1	Clerks	83
Chief clerk	1	Chief folder	1
Assistant in charge of indexing	1	Folders	4
Assistant in charge of illustrations	1	Skilled laborers	51
Assistant editors	7	Messengers	12
Indexer	1	Messenger boys	3
Draftsmen	3	Laborers	3
Photographers	6	Charwomen	7
Assistant photographer	1		
Assistant in document section	1	Total	192
Foreman in miscellaneous distribution	1		
Foreman in Farmers' Bulletin distribution	1		

BUREAU OF STATISTICS.

Total force on the rolls on July 1, 1909 159
Total force on the rolls on July 1, 1910 163

Classification and number of persons in the Bureau of Statistics on July 1, 1910.

Classification.	Number.	Classification.	Number.
Statistician and Chief of Bureau	1	State statistical agents	45
Associate Statistician	1	Special field agents	17
Assistant Statistician and Assistant Chief of Bureau	1	Special agents	4
Chief clerk of Bureau	1	Clerks	78
Statistical scientist in charge of division of domestic crop reports	1	Messengers	4
Statistical scientist in charge of editorial division and library	1	Messenger boy	1
Statistical scientist in charge of investigations of production and distribution	1	Laborers	2
Statistical scientist and assistant in the investigations of production and distribution	1	Charwomen	4
		Total	163

LIBRARY.

Total force on the rolls on July 1, 1909 20
Total force on the rolls on July 1, 1910 21

Classification and number of persons in the Library on July 1, 1910.

Classification.	Number.	Classification.	Number.
Librarian	1	Clerks	8
Assistant Librarian	1	Messengers	3
Cataloguers	5	Charwoman	1
Clerk and translator	1		
Clerks and scientific assistants	6	Total	21

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OFFICE OF EXPERIMENT STATIONS.

Total force on the rolls on July 1, 1909..... 214
Total force on the rolls on July 1, 1910..... 190

Classification and number of persons in the Office of Experiment Stations on July 1, 1910.

Classification.	Number.	Classification.	Number.
Director of the Office	1	Irrigation engineers	8
Assistant Director of the Office	1	Irrigation managers	4
Chief of editorial division	1	Irrigation farmers	4
Chief of division of insular stations	1	Supervising drainage engineer	1
Chief of irrigation investigations	1	Drainage engineers	16
Chief of drainage investigations	1	Assistant drainage engineers	10
Chief clerk	1	Special agent in charge of Alaska experiment station	1
Assistant chief of irrigation investigations	1	Special agent in charge of Hawaii experiment station	1
Specialist in agricultural education	1	Special agent in charge of Porto Rico experiment station	1
Assistant in agricultural education	1	Special agent in charge of Guam experiment station	1
Farmers' institute specialist	1	Scientific assistants	17
Nutrition expert	1	Special experts	16
Assistant agriculturist	1	Draftsmen	3
Assistant nutrition physiologist	1	Special agents	17
Assistant farmers' institute specialist	1	Collaborators	2
Editor of entomological and veterinary science	1	Computer in charge of accounts	1
Editor of animal husbandry	1	Clerks	28
Editorial assistants	2	Stenographers and typewriters	11
Clerk and proof reader	1	Typewriter	1
Assistant in charge of the library of the office of experiment stations	1	Messengers	4
Assistant in biological chemistry	1	Messenger boys	2
Assistant in agronomy	1	Manual laborer	1
Plant pathologist and entomologist	1	Charwomen	7
Assistant animal husbandman	1		
Assistant in chemistry	1	Total	190
Office engineers	4		
Assistant office engineers	3		

OFFICE OF PUBLIC ROADS.

Total force on the rolls on July 1, 1909..... 65
Total force on the rolls on July 1, 1910..... 101

Classification and number of persons in the Office of Public Roads on July 1, 1910.

Classification.	Number.	Classification.	Number.
Director	1	Assistants in road material laboratory	2
Assistant Director	1	Helper in road material laboratory	1
Chief engineer	1	Petrographer	1
Highway engineers	6	Consulting engineer and expert on bridge construction	1
Assistant highway engineers	2	Scientific assistants	2
Junior highway engineers	6	Special agent and consulting engineer	1
Civil engineer students	7	Special agents	14
Chief of road management	1	Photographer	1
Senior assistant in road management	1	Instrument maker	1
Consulting engineer and road expert	1	Carpenters	3
Superintendents of road construction	10	Messenger	1
Road experts	3	Messenger boys	2
Expert in cements	1	Laborers	3
Experts	4		
Chief clerk	1	Total	101
Clerks	14		
Assistant chemists	3		

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PLACE OF EMPLOYMENT.

The number of officers and employees in the different branches of the United States Department of Agriculture stationed in Washington, D. C., and the number employed outside of Washington, D. C., on July 1, 1910, was as follows:

Branch of the Department.	Number of officers and employees—		
	Stationed in Washington, D. C.	Stationed outside of Washington, D. C.	Total.
Office of the Secretary	212	.....	212
Weather Bureau	210	1,807	2,017
Bureau of Animal Industry	278	2,897	3,175
Bureau of Plant Industry	572	900	1,472
Forest Service	239	3,397	3,636
Bureau of Chemistry	235	267	502
Bureau of Soils	67	69	136
Bureau of Entomology	71	471	542
Bureau of Biological Survey	39	29	68
Division of Accounts and Disbursements	45	8	53
Division of Publications	192	.....	192
Bureau of Statistics	97	66	163
Office of Experiment Stations	89	101	190
Library	21	.....	21
Office of Public Roads	47	54	101
Total	2,414	10,066	12,480

PAY-ROLL CLASSIFICATION OF OFFICERS AND EMPLOYEES.

The following statement shows the number of persons, on July 1, 1910, occupying statutory positions on what are known as the statutory rolls of the Department, being specific positions especially created by act of Congress making appropriations for the United States Department of Agriculture; also the total number of persons in the said Department paid from miscellaneous or lump-sum funds appropriated by act of Congress as aforesaid, in which specific positions are not created:

Officers and employees of the Department on statutory rolls and those paid from lump-sum funds July 1, 1910.

Bureau, Division, Office, etc.	On statutory rolls.	On lump-sum funds.	Total.
Office of the Secretary	203	9	212
Weather Bureau	192	1,825	2,017
Bureau of Animal Industry	98	3,077	3,175
Bureau of Plant Industry	278	1,194	1,472
Forest Service	60	3,576	3,636
Bureau of Chemistry	73	429	502
Bureau of Soils	32	104	136
Bureau of Entomology	24	518	542
Bureau of Biological Survey	31	37	68
Division of Accounts and Disbursements	53	.....	53
Division of Publications	192	.....	192
Bureau of Statistics	97	66	163
Office of Experiment Stations	47	143	190
Library	20	1	21
Office of Public Roads	20	81	101
Total	1,420	11,060	12,480

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COMMISSIONERS AND SECRETARIES OF AGRICULTURE.

Name and length of service of each Commissioner and of each Secretary of Agriculture since the organization of the United States Department of Agriculture, July 1, 1862.

Name.	Rank.	Appointed under the administration of President—	When appointed.	Service terminated.
Isaac Newton	Commissioner	Abraham Lincoln	July 1, 1862	June 19, 1867
John W. Stokes	do	Andrew Johnson	June 20, 1867	Dec. 4, 1867
Horace Capron	do	do	Dec. 5, 1867	July 31, 1871
Frederick Watts	do	Ulysses S. Grant	Aug. 1, 1871	June 30, 1877
Wm. G. Le Duc	do	Rutherford B. Hayes	July 1, 1877	June 30, 1881
Geo. B. Loring	do	James A. Garfield	July 1, 1881	Apr. 3, 1885
Norman J. Colman	do	Grover Cleveland	Apr. 4, 1885	Feb. 12, 1889
Do	Secretary	do	Feb. 13, 1889	Mar. 6, 1889
J. M. Rusk	do	Benjamin Harrison	Mar. 7, 1889	Mar. 6, 1893
J. Sterling Morton	do	Grover Cleveland	Mar. 7, 1893	Mar. 5, 1897
James Wilson	do	William McKinley	Mar. 6, 1897	
Do	do	do	Mar. 6, 1901	
Do	do	Theodore Roosevelt	Mar. 6, 1905	
Do	do	William H. Taft	Mar. 5, 1909	

PRINCIPAL OFFICERS OF THE DEPARTMENT.

Principal officers of the several bureaus, divisions, and offices of the Department of Agriculture on July 1, 1910.

OFFICE OF THE SECRETARY.

Position.	Name.	Salary per annum.
Secretary of Agriculture	James Wilson	$12,000
Assistant Secretary	Willet M. Hays	5,000
Solicitor	George P. McCabe	4,500
Chief clerk and custodian of buildings	Sylvester R. Burch	3,000
Private secretary to the Secretary of Agriculture	Jasper Wilson	2,500
Appointment clerk	Joseph B. Bennett	2,000
Private secretary to the Assistant Secretary of Agriculture.	George W. Knorr	1,600
Chief of Supply Division	Cyrus B. Lower	2,000
Chief engineer and captain of the watch	Lewis Jones	1,600

WEATHER BUREAU.

[Corner Twenty-fourth and M streets NW. Phone, West 1640.]

Chief of Bureau	Willis L. Moore	$6,000
Assistant Chief	Henry E. Williams	3,000
Chief clerk	Daniel J. Carroll	2,250
In charge of—		
Forecast Division	Prof. Harry C. Frankenfield *	3,500
	District Forecaster Edward H. Bowie*	3,000
River and Flood Division	Prof. Harry C. Frankenfield	3,500
Climatological Division	Prof. Frank H. Bigelow	3,000
Instrument Division	Prof. Charles F. Marvin	3,000
Accounts Division	Edgar B. Calvert	3,000
Observatory	George E. Hunt	2,500
Chiefs of division:		1,800
Distributing	James Berry	2,750
Marine meteorology	Henry L. Heiskell	2,000
Publications	John P. Church	2,000
Supplies	Robert Seyboth	2,000
Telegraph	Jesse H. Robinson	2,000
Librarian	Charles F. Talman	2,000
In charge of forecast districts:		2,000
Chicago, Ill	Prof. Henry J. Cox a	3,000
San Francisco, Cal	Prof. Alexander G. McAdie a	3,000
Denver, Colo	Frederick H. Brandenburg a	2,400
New Orleans, La	Isaac M. Cline a	2,400
Portland, Oreg	Edward A. Beals a	2,400

* Alternate monthly.

a Also climatological editor.

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Principal officers of the several bureaus, divisions, and offices of the Department of Agriculture on July 1, 1910—Continued.

WEATHER BUREAU—Continued.

Position.	Name.	Salary per annum.
District forecasters:		
Boston, Mass.	John W. Smith	$2,400
Buffalo, N. Y.	David Cuthbertson	2,400
Louisville, Ky.	Ferdinand J. Walz [a]	2,400
New York, N. Y.	James H. Scarr	2,400
Inspectors:		
Detroit, Mich.	Norman B. Conger	2,500
Milwaukee, Wis.	Henry B. Hersey	2,500
Climatological editors:		
Atlanta, Ga.	Charles F. von Herrmann	2,000
Des Moines, Iowa	George M. Chappel [b]	1,000
Houston, Tex.	Bernard Bunnemeyer	2,000
Ithaca, N. Y.	Willford M. Wilson	2,000
St. Louis, Mo.	Montrose W. Hayes	2,000
Salt Lake City, Utah	Alfred H. Thiessen	1,800
RESEARCH STAFF, MOUNT WEATHER, VA.		
Executive officer in charge	Prof. Alfred J. Henry	3,500
In charge of—		
Physical laboratory	Prof. William J. Humphreys	3,000
Solar-radiation work	Prof. Herbert H. Kimball	2,500
Upper-air research	William R. Blair	2,000
Editor of Mount Weather Bulletin	Prof. Cleveland Abbe	2,500

[a] Also climatological editor. [b] Receives additional compensation from State.

BUREAU OF ANIMAL INDUSTRY.

Chief of Bureau	Alonzo D. Melvin	$5,000
Assistant Chief	Arthur M. Farrington	3,000
Chief clerk	Charles C. Carroll	2,000
Chiefs of division:		
Animal Husbandry	George M. Rommel	2,500
Biochemic	Marion Dorset	4,000
Dairy	B. H. Rawl	2,500
Inspection	Rice P. Steddom	3,500
Pathological	John R. Mohler	4,000
Quarantine	R. W. Hickman	3,000
Zoological	Brayton H. Ransom	2,750
Editor and compiler	James M. Pickens	2,000
Superintendent of experiment station	E. C. Schroeder	3,250

BUREAU OF PLANT INDUSTRY.

ADMINISTRATION.		
Pathologist and Physiologist and Chief of Bureau	Beverly T. Galloway	$5,000
Pomologist and Assistant Chief of Bureau	G. Harold Powell	4,000
Chief clerk	James E. Jones	2,250
Editor	J. E. Rockwell	2,000
Officer in charge of records	W. P. Cox	2,000
PATHOLOGY.		
Pathologist in charge of laboratory of plant pathology	Erwin F. Smith	3,240
Pathologist in charge of laboratory of forest pathology	Haven Metcalf	2,460
Pathologist in charge of cotton and truck crop diseases and sugar plant investigations	William A. Orton	2,750
Pathologist in charge of fruit diseases	Merton B. Waite	3,000
PHYSIOLOGY.		
Physiologist in charge of crop physiology and breeding investigations	Walter T. Swingle	3,000
Physiologist in charge of soil bacteriology and water purification investigations	Karl F. Kellerman	2,500
Bionomist in charge of crop acclimatization and adaptation investigations	O. F. Cook	3,000
Physiologist in charge of drug plant, poisonous plant, and tea culture investigations	Rodney H. True	3,000

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Principal officers of the several bureaus, divisions, and offices of the Department of Agriculture on July 1, 1910—Continued.

BUREAU OF PLANT INDUSTRY—Continued.

Position.	Name.	Salary per annum.
TECHNOLOGY.		
Agricultural technologist in charge of crop technology investigations.	Nathan A. Cobb	$3,240
Botanist in charge of fiber investigations	Lyster H. Dewey	2,500
Crop technologist in charge of grain standardization	John D. Shanahan	3,000
Physicist in charge of physical investigations	Lyman J. Briggs	2,750
Botanist in charge of seed laboratory	Edgar Brown	2,500
AGRONOMY.		
Cerealist in charge of grain investigations	Mark A. Carleton	3,000
Physiologist in charge of tobacco and nutrition investigations.	W. W. Garner	2,160
Physiologist in charge of alkali and drought resistant plant breeding investigations.	Thomas H. Kearney	2,500
Physiologist in charge of corn investigations	Charles P. Hartley	2,000
Botanist in charge of taxonomic and range investigations.	Frederick V. Coville	3,240
DEMONSTRATIONS.		
Agriculturist in charge of farm management investigations.	W. J. Spillman	3,750
Special agent in charge of farmers' cooperative demonstration work.	Seaman A. Knapp	3,750
Agriculturist in charge of dry land agriculture investigations.	E. C. Chilcott	3,000
Agriculturist in charge of western agricultural extension.	Carl S. Scofield	2,760
HORTICULTURE.		
Pomologist in charge of pomological collections	G. B. Brackett	3,000
Pomologist in charge of field investigations in pomology.	Wm. A. Taylor	3,500
Assistant in charge of pathological and physiological plant houses and department grounds.	E. M. Byrnes	2,160
Horticulturist in charge of Arlington farm and horticulture.	L. C. Corbett	3,240
Superintendent of vegetable testing gardens	W. W. Tracy, sr	3,000
FIELD GARDENS.		
Pomologist in charge of south Texas garden, Brownsville, Tex.	Edward C. Green	2,280
Botanist in charge of plant introduction garden, Chico, Cal.	Walter Van Fleet	1,800
SEEDS.		
Agrostologist in charge of forage crop investigations	C. V. Piper	3,000
Assistant in general charge of seed distribution	Leon M. Estabrook	2,250
Agricultural explorer in charge of foreign seed and plant introduction.	David Fairchild	2,750

FOREST SERVICE.

[Atlantic Building, 928-930 F street. Phone, Main 3572.]

Forester and Chief	Henry S. Graves	$5,000
Associate Forester	Albert F. Potter	4,000
General inspector	Daniel D. Bronson	2,000
Editor	Herbert A. Smith	3,000
Chief of publications	Findley Burns	1,800
Dendrologist	George B. Sudworth	2,800
BRANCH OF OPERATION.		
Assistant forester in charge	James B. Adams	3,500
Assistant forester	Clyde Leavitt	2,200
Assistant in office methods	George G. Anderson	2,000
Office of geography: Chief	Fred G. Plummer	2,500
Office of maintenance: Chief	George A. Bentley	1,500

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Principal officers of the several bureaus, divisions, and offices of the Department of Agriculture on July 1, 1910—Continued.

FOREST SERVICE—Continued.

Position	Name.	Salary per annum
BRANCH OF SILVICULTURE.		
Assistant forester in charge	William T. Cox	$2,800
Assistant forester	Edward E. Carter	2,500
Office of state and private cooperation:		
Chief	J. Girven Peters	1,800
Assistant chief	J. Harold Foster	1,400
Office of silvics:		
Chief	Raphael Zon	2,200
Assistant chief	Samuel T. Dana	1,600
BRANCH OF GRAZING.		
Associate forester in charge	Albert F. Potter	4,000
Assistant forester	Leon F. Kneipp	2,500
Inspector of grazing	Will C. Barnes	2,400
BRANCH OF LANDS.		
Assistant forester in charge	James B. Adams	3,500
Office of occupancy: In charge	W. W. Dyar	2,200
Office of claims: In charge	James I. Parker	2,750
BRANCH OF PRODUCTS (MADISON, WIS.).		
Assistant forester in charge	William L. Hall	3,250
Director	McGarvey Cline	2,000
Assistant director	Howard S. Bristol	2,000
Do	Howard F. Weiss	2,000
Office of wood utilization (Chicago, Ill.): Chief	Homer S. Sackett	1,700
Washington office: In charge	Orrington T. Swan	1,600
DISTRICT OFFICES.		
District No. 1, Missoula, Mont.		
District forester	Wm. B. Greeley	2,500
Associate district forester	Ferdinand A. Silcox	2,200
Office of operation: Assistant district forester	Jos. P. Martin	2,000
Office of silviculture: Assistant district forester	R. Y. Stuart	1,800
Office of grazing: Assistant district forester	Charles H. Adams	2,000
Office of lands: Assistant district forester	Richard H. Rutledge	2,000
Office of products: In charge	P. R. Hicks	1,200
District No. 2, Denver, Colo.		
District forester	Smith Riley	2,500
Associate district forester	Paul G. Redington	2,200
Office of operation: Assistant district forester	Fred W. Morrell	1,900
Office of silviculture: Assistant district forester	S. L. Moore	1,700
Office of grazing: Assistant district forester	Jesse W. Nelson	2,000
Office of lands: Assistant district forester	Carl J. Stahl	1,800
Office of products: Assistant district forester	Harold S. Betts	2,000
District No. 3, Albuquerque, N. Mex.		
District forester	Arthur C. Ringland	2,500
Associate district forester	Earle H. Clapp	2,200
Office of operation: Assistant district forester	Alpheus O. Waha	2,000
Office of Silviculture: Assistant district forester	Theodore S. Woolsey, jr	2,000
Office of Grazing: Assistant district forester	Jos. K. Campbell	1,900
Office of Lands: Assistant district forester	Frank C. W. Pooler	2,000
District No. 4, Ogden, Utah.		
District forester	Edward A. Sherman	2,500
Associate district forester	Franklin W. Reed	2,100
Office of Operation: Assistant district forester	Arthur C. McCain	1,800
Office of Silviculture: Assistant district forester	Leslie L. White	2,000
Office of Grazing: Assistant district forester	Homer E. Fenn	2,000
Office of Lands: Assistant district forester	Timothy C. Hoyt	1,800
Supply depot, property clerk	A. M. Smith	2,000
Property auditor	J. G. Falck	1,700

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FOREST SERVICE—Continued.

Position.	Name.	Salary per annum.
District No. 5, San Francisco, Cal.		
District forester	Frederick E. Olmsted	$3,000
Associate district forester	Coert DuBois	2,400
Office of Operation: Assistant district forester	Roy Headley	1,900
Office of Silviculture: Assistant district forester	Trueman D. Woodbury	1,900
Office of Grazing: Assistant district forester	John H. Hatton	2,100
Office of Lands: Assistant district forester	L. A. Barrett	2,100
Office of Products: Assistant district forester	C. Stowell Smith	1,900
District No. 6, Portland, Oreg.		
District forester	Charles S. Chapman	2,500
Associate district forester	George H. Cecil	2,200
Office of Operation: Assistant district forester	Charles H. Flory	2,000
Office of Silviculture: Assistant district forester	Fred E. Ames	1,900
Office of Grazing: Assistant district forester	Howard K. O'Brien	2,000
Office of Lands: Assistant district forester	Clarence J. Buck	1,900
Office of Products: Assistant district forester	Joseph B. Knapp	1,900

BUREAU OF CHEMISTRY.

Chemist and Chief of Bureau	H. W. Wiley	$5,000
Associate Chemist	F. L. Dunlap	4,000
Assistant Chief of Bureau and Chief of Division of Foods	W. D. Bigelow	4,000
Chief clerk	F. B. Linton	1,800
Editorial clerk	A. L. Pierce	1,800
Librarian	M. W. Taylor	1,600
DIVISION OF FOODS.		
Chief of division	W. D. Bigelow	4,000
Food Inspection Laboratory: Chief	L. M. Tolman	3,000
Food Technology Laboratory: Chief, and assistant chief of division.	E. M. Chace	2,760
Oil, Fat, and Wax Laboratory: Chief	H. S. Bailey	1,600
DIVISION OF DRUGS.		
Chief of division	L. F. Kebler	3,500
Chief food and drug inspector	W. G. Campbell	2,600
Drug Inspection Laboratory: Chief	G. W. Hoover	2,040
Synthetic Products Laboratory: Chief	W. O. Emery	2,280
Pharmacological Laboratory: Acting chief	William Salant	2,500
MISCELLANEOUS DIVISION.		
Chief of division	J. K. Haywood	3,000
Water Laboratory: Acting chief	W. W. Skinner	2,520
Cattle Food and Grain Laboratory: Acting chief	G. L. Bidwell	1,620
Insecticide and Fungicide Laboratory: Acting chief	C. C. McDonnell	2,000
CONTRACTS LABORATORY.		
Chief	P. H. Walker	2,760
DAIRY LABORATORY.		
Chief	G. E. Patrick	2,760
LEATHER AND PAPER LABORATORY.		
Chief	F. P. Veitch	2,760
MICROCHEMICAL LABORATORY.		
Chief	B. J. Howard	2,520
SUGAR LABORATORY.		
Chief	A. H. Bryan	2,520
NITROGEN SECTION.		
In charge	T. C. Trescot	2,760
PLANT PHYSIOLOGICAL LABORATORY.		
Chief	J. A. LeClerc	2,760

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BUREAU OF CHEMISTRY—Continued.

Position.	Name.	Salary per annum.
FOOD RESEARCH LABORATORY.		
Chief	M. E. Pennington	$2,760
SPECIAL INVESTIGATIONS.		
Physiological chemistry (animal): In charge	F. C. Weber	2,250
Bacteriological chemistry: In charge	G. W. Stiles	2,280
Enological chemistry: In charge	W. B. Alwood	2,280
FOOD AND DRUG INSPECTION LABORATORIES.		
Boston, Mass.: Chief	B. H. Smith	2,760
Buffalo, N. Y.: Acting chief	W. L. DuBois	2,000
Chicago, Ill.: Chief	A. L. Winton	3,000
Cincinnati, Ohio: Chief	B. R. Hart	2,040
Denver, Colo.: Chief	A. E. Leach	3,000
Detroit, Mich.: Chief	H. L. Schuls	2,040
Galveston, Tex.: Acting chief	T. F. Pappe	1,800
Kansas City, Mo.: Chief	A. V. H. Mory	2,000
Nashville, Tenn.: Acting chief	R. W. Balcom	1,800
New Orleans, La.: Chief	C. W. Harrison	2,000
New York, N. Y.: Acting chief	R. E. Doolittle	3,000
Omaha, Nebr.: Chief	S. H. Ross	2,040
Philadelphia, Pa.: Chief	C. S. Brinton	2,280
Pittsburg, Pa.: Chief	M. C. Albrech	1,800
Portland, Oreg.: Chief	A. L. Knisely	2,000
St. Louis, Mo.: Chief	D. B. Bisbee	2,040
St. Paul, Minn.: Chief	A. S. Mitchell	3,000
San Francisco, Cal.: Chief	R. A. Gould	2,500
Savannah, Ga.: Chief	W. C. Burnet	2,040
Seattle, Wash.: Acting chief	H. M. Loomis	2,000
REFEREE BOARD.		
Consulting scientific expert to the Secretary of Agriculture, and chairman of the Referee Board.	Dr. Ira Remsen	2,000
Consulting scientific expert to the Secretary of Agriculture.	Dr. Russell H. Chittenden	2,000
Do	Dr. Christian A. Herter	2,000
Do	Dr. John H. Long	2,000
Do	Dr. Alonzo E. Taylor	2,000

BUREAU OF SOILS.

Soil Physicist and Chief of Bureau	Milton Whitney	$3,500
Chief clerk	A. G. Rice	2,000
Scientist in soil laboratory investigations	Frank K. Cameron	3,250
Do	Oswald Schreiner	3,000
Scientist in soil survey	Jay A. Bonsteel	3,250
Expert in soil water investigations	W J McGee	3,000

BUREAU OF ENTOMOLOGY.

Entomologist and Chief	L. O. Howard	$4,000
Entomologist and Acting Chief in Absence of Chief	C. L. Marlatt	3,000
Executive assistant	R. S. Clifton	2,250
Chief clerk	W. F. Tastet	1,800
In charge of—		
Truck crop and stored product insect investigations	F. H. Chittenden	2,750
Forest insect investigations	A. D. Hopkins	2,750
Southern field crop insect investigations	W. D. Hunter	2,750
Cereal and forage insect investigations	F. M. Webster	2,750
Deciduous fruit insect investigations	A. L. Quaintance	2,750
Apicultural investigations	E. F. Phillips	2,750

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Principal officers of the several bureaus, divisions, and offices of the Department of Agriculture on July 1, 1910—Continued.

BUREAU OF BIOLOGICAL SURVEY.

Position.	Name.	Salary per annum.
Biologist and Chief of Bureau	H. W. Henshaw	$3,000
Consulting biologist	C. Hart Merriam	1,000
Assistant Chief and in charge of game preservation	T. S. Palmer	2,900
Assistants in charge of—		
Economic investigations	A. K. Fisher	2,850
Biological investigations	Vernon Bailey	2,850

DIVISION OF ACCOUNTS AND DISBURSEMENTS.

Chief of Division and Disbursing Clerk	A. Zappone	$3,250
Assistant Chief	E. B. Calvert	2,500
Chief of Office of Accounts and fiscal agent	M. E. Fagan	2,500
Cashier and chief clerk	A. W. Smith	2,000
Auditor	E. D. Yerby	2,000
Do	W. J. Nevius	2,000
District Fiscal agent	E. A. Melzar	2,000
Do	A. H. Cousins	2,000
Do	Q. R. Craft	2,000
Do	Jno. J. Duffy	2,000
Do	William R. Fuchs	2,000
Do	Hamilton I. Loving	2,000
Do	Frank C. Thompson	2,000
Do	John A. Urbanowicz	2,000
Bookkeeper	F. W. Legge	1,800
In charge of transportation	E. E. Forbes	1,800

DIVISION OF PUBLICATIONS.

Editor and Chief	Jos. A. Arnold	$3,000
Editor and Assistant Chief	D. B. Stallings	2,250
Chief clerk	A. I. Mudd	2,000
Assistants in charge of—		
Document Section		2,000
Illustrations	L. S. Williams	2,000
Indexing	C. H. Greathouse	1,800

BUREAU OF STATISTICS.

Statistician and Chief of Bureau	Victor H. Olmsted	$3,500
Associate Statistician	Nat C. Murray	2,800
Assistant Statistician	Charles C. Clark	2,500
Chief clerk	Samuel A. Jones	1,800
Chief of Division of Production and Distribution	George K. Holmes	3,000
Chief of Editorial Division and Library	Charles M. Daugherty	2,500
Chief of Division of Domestic Crop Reports	Fred J. Blair	2,000

LIBRARY.

Librarian	Claribel R. Barnett	$2,000
Assistant Librarian	Emma B. Hawks	1,400

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Principal officers of the several bureaus, divisions, and offices of the Department of Agriculture on July 1, 1910—Continued.

OFFICE OF EXPERIMENT STATIONS.

Position.	Name.	Salary per annum.
Director	A. C. True	$4,000
Assistant Director, and editor of Experiment Station Record.	E. W. Allen	3,500
Chief clerk	Mrs. C. E. Johnston	1,800
Chief of—		
Editorial Division	W. H. Beal	2,700
Division of Insular Stations	Walter H. Evans	2,700
Irrigation Investigations	Samuel Fortier	3,500
Drainage Investigations	C. G. Elliott	3,500
In charge of—		
Alaska Experiment Stations	C. C. Georgeson	3,000
Guam Experiment Stations	J. B. Thompson	2,500
Hawaii Experiment Stations	E. V. Wilcox	3,000
Porto Rico Experiment Stations	D. W. May	3,000
Nutrition Investigations	C. F. Langworthy	2,500
Accounts	F. E. Singleton	2,000
Specialists—		
In agricultural education	D. J. Crosby	2,400
In farmers' institutes	John Hamilton	2,250

OFFICE OF PUBLIC ROADS.

Director	Logan W. Page	$3,000
Chief chemist	Allerton S. Cushman	3,000
Chief engineer	Vernon M. Pierce	2,500
Chief of Road Management	J. E. Pennybacker, jr	2,000
Chief clerk	W. Carl Wyatt	1,600

ADDENDA.

WHO ARE MEMBERS OF A FAMILY.

[Civil-service act (22 Stat. L., 403). An act to regulate and improve the civil service of the United States.]

The civil-service act provides in section 9 as follows:

SEC. 9. That whenever there are already two or more members of a family in the public service in the grades covered by this act, no other member of such family shall be eligible to appointment to any of said grades.

The Attorney-General of the United States has decided as follows:

The "family" consists of those who live under the same roof with the pater familias—those who form his fireside; but when they branch out and become heads of new establishments they cease to be part of the father's family. (26 Op. A. G., 301.)

These decisions are held to apply to reinstatements as well as to appointments. (Rule IX, p. 45, Reinstatements, Civil Service Rules, edition of May, 1910.)

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INDEX.

Page.

Acclimatization, corn, remarks 314
crops, change from annual to perennial, Hawaii and Guam. 146, 147
work with cotton, corn, etc 291–295
tropical crops and ornamental trees 295
Accounts and Disbursements Division, contracts and bonds, preparation by Solicitor 888
force, number and classification 905
officers 915
report of Chief 567–619
review of work by Secretary 131–133
1908, close 574–575
falsification, cases 885
Acetic acid, standard, difficulty in securing 447
Acid. *See* Boric; Carbolic; Citric; Nitric; Phosphoric; Sulphurous, etc.
Adams Act, beneficial effect of, and estimate for support of work 138
Administrative publications, increase and cost 135
Agreements, preparation for the several Bureaus, Offices, and Divisions 887–888
Agricultural Colleges and Experiment Stations, Association of American, relation of Office of Experiment Stations 741
growth of work, remarks by Secretary 142–143
explorations, central Asia and Palestine 355
extension, western, review 320–323
institutes for farmers, different types, work, etc 742–745
libraries, consideration by American Library Association 137
Section, steps toward organization 733–734
production, 1910 9–19
per acre for many years 710–712
relation to population 708–710, 713–716
products, foreign trade, exports and imports 17–19
value, 1910 9–10
schools, increase, remarks by Secretary 142–143
technology, investigations 61–62, 300–303
trains, importance, work, etc 743
Agriculture, Commissioners and Secretaries, terms of service 909
Department, administration of acts of Congress 796–870
appointments, promotions, etc., 1910 897–898
appropriations, disbursements, and expenditures, 1839–1910 591–619
changes in force, 1910 ..... 36, 897–898
cooperation with War Department in horse breeding, study 208, 219–229
deaths of employees, 1910 898–899
establishment and growth 900–916
officers and employees, classification 900–907
of the several Bureaus, Divisions, and Offices 909–916
pay-roll classification of officers and employees 908
property, conversion, prosecution of cases 885
work, 1910, review by Secretary 33–157
dry-land investigations, work 69–71
Office, cooperative studies of plant-food absorption 448
Secretary, general and special orders issued 891–895
Office, force, number and classification 900
officers 909
publications issued during year, class, title, number, etc 642–656
recommendations 41, 52–53, 95, 138

Digitized by Google

Page.
Alabama, beef production, cooperative investigations ... 217–218
Alaska, bird and mammal specimens for Alaska-Yukon-Pacific Exposition, permits, etc ... 560
Experiment Stations, changes, work, etc ... 749–751
review of work by Secretary ... 145
game, protection ... 129, 559–560
weekly forecasts, aid to Weather Bureau ... 172
Alcohol, denatured, manufacture, studies ... 453, 456–457
toxicity, pharmacological studies with dogs ... 446
Alfalfa, cross with cowpeas, work ... 354
curing, use of artificial hay drier ... 81
experiments ... 359
growing in the East, comparison with clover, experiments ... 359
South ... 327
seed, importations, increase ... 84
production in United States, note ... 84
value as forage crop ... 83, 84
weevil, investigations ... 120, 531
Alfalfas, hardy from Asia, crossing for new varieties for Northwest ... 78
varieties from Asia, introduction ... 78
Alkali extracts, cooperative studies ... 448
resistant crops, breeding ... 323–325
Alkaloids, study by Chemistry Bureau ... 451
Amygdalus davidiana, use as stock for grafting stone fruits ... 356
Anarcardium occidentale, tropical nuts, analysis and testing ... 464–465
Anastatus bifasciatus, moth parasite, importation, cold resistance, etc ... 114, 517
Animal breeding, experiments at Bethesda, Md., experiment station ... 215
diseases, eradication work ... 47–50
scientific investigations ... 50–51
Husbandry Division, work, 1910 ... 44–45, 211–214
Industry Bureau, appropriations, disbursements, and balance ... 570
breeding horses for United States Army, proposed work ... 219–229
contracts and leases, preparation by Solicitor ... 887
cooperation with Biological Survey ... 532
force, number and classification ... 901
officers ... 910
publications, 1910, new and reprints ... 211, 656–662
report of Chief, 1910 ... 199–277
review of work by Secretary ... 42–53
work, relation to public health ... 31, 202–204
parasites, studies by Animal Industry Bureau ... 272–274
Animals, export, inspection and quarantine ... 51–52, 248–249
feeding experiments by Chemistry Bureau ... 449–450
nutritive value of glucose and cane sugar, comparative experiments ... 449
imported, inspection and quarantine, 1910 ... 52, 249–250
inspection, number and kind ... 199–202, 243–244, 248–250
Anthrax, control methods, studies ... 260–261
Antitoxins, importation, necessity for control legislation ... 209
Aphis, melon, investigations ... 533–534
Apiculture, work of Porto Rico experiment station ... 754
Apple, by-products, laboratory studies ... 451–452
injury by spraying, remarks ... 283–284
investigations, Sandusky, Ohio ... 451–452
juice, keeping methods ... 437
Paradise, introduction as stock free from crown-gall ... 78
pollination experiments, remarks by Secretary ... 141
powdery mildew, control, note ... 55
rust from red cedar, remarks ... 54, 282
stocks, varietal, propagation, work ... 354
Apples, cross with Alaskan crab apple, experiments ... 750
Oregon and Washington, labeling, studies ... 456
storage, investigations in California ... 348
Appointment Clerk, report, 1910 ... 897–916
Appropriations, Agriculture Department, 1910 ... 568–569

Digitized by Google

Page.
Appropriations, Agriculture Department, 1911 ... 581–586
remarks by Secretary ... 131, 132
disbursements, and unexpended balances, 1910, table ... 569–572
estimates for 1911 ... 576–581
experiment stations, remarks by Secretary ... 138
Plant Industry Bureau, 1911, totals ... 279
Publications Division, 1907–1910 ... 621
Apricots, varieties from Asia, introduction ... 78
Argentine ant, investigations ... 521–522
Arlington Experimental Farm, future work ... 342
review of work ... 73, 339–343
Army horses. *See* Horses, army.
ARNOLD, JOS. A., report as Editor and Chief of Division of Publications ... 621–694
Aroid root crops, experiments ... 78, 357–358
Arsenate of lead. *See* Lead arsenate.
Arsenic, accumulation in soil, cooperative studies ... 527–528
accumulations in soil from spraying, note ... 120
occurrence in food products, investigations ... 438
use in cattle dips ... 273–274
coloring sausage casings, determination tests ... 268
Arsenite of soda, use against weeds ... 753
Asia, central, agricultural explorations, results, etc ... 355
southwestern, plant resources, explorations by Department expert ... 77–78
Asparagus, rust-resistant, breeding ... 287
Aspen trees, value, investigations ... 410
Aspergillus, mold species, studies ... 241
Avocado industry, development ... 358

Bacteria, alkali-forming, studies ... 239
lactic-acid-forming, cultural characteristics, study ... 238
milk and butter, relation to keeping quality ... 141
Bacterial preparations, rat-destroying, value ... 122
Bacteriochemical investigations, food and drugs, work, 1910 ... 433–434
Bacteriology, soil, study ... 57, 287–288
Bacterium tumefaciens, relation to crown-gall disease ... 281
Balkan States, agriculture, etc., investigations by Bureau of Statistics ... 702
Balloon ascensions, weather conditions governing ... 162
flights, highest altitude reached ... 163
Balloons, rubber, use in upper air observations ... 162–163
sounding, use in upper air observations ... 162–163
use in weather research work ... 37, 38
Baltimore, location of quarantine station, note ... 209
Bamboo garden, Florida, work, outlook, etc ... 357
Japanese timber, growing in United States, experiments, note ... 77
Barium, presence in soils, distribution, etc ... 502
Barkbeetle, control measures, success ... 118–119
Barkbeetles, control, new work proposed by Entomology Bureau ... 524
depredations, National Forests, and control work, 1910 ... 524
Barley, bleaching, investigations ... 456
composition, studies by Chemistry Bureau ... 448
crop, 1910, yield and value ... 14–15
investigations, remarks ... 67, 313
production per acre, variations for several years ... 711, 712
varieties, changes in composition, studies ... 448
BARNETT, CLARIBEL R., report as Librarian, 1910 ... 723–734
Bean, Yokohama, value as forage crop, studies in South ... 85–86
Beans, canned, analysis and testing ... 465
Bee culture. *See* Bee keeping.
diseases, control, investigations, Entomology Bureau ... 544
keeping, studies and work, Entomology Bureau ... 543–546
work of Porto Rico experiment station ... 754
organic structure and development, studies ... 544
Beef extracts, analyses by Chemistry Bureau ... 449
prices, increase ... 19
variation with localities and quality of meat ... 20
production, feeding experiments at Alabama Experiment Station ... 217–218

Digitized by Google

	Page.
Beef production, importance of pastures, studies	81
investigations, Alabama, profits per head	44
Bees, activity, investigations	545
Beeswax, extraction, study of methods, etc	545
Beet, sugar, seed, Congressional distribution, production, etc	362
studies	57, 287
See also Sugar, beet.	
Beetle, Black Hills, control investigations	522–524
Beetles, varieties, injury to forests and forest products, control	522–524
Beets, sugar, analysis, study of methods	432
farm practice	330
Belgium, inspection against insects, note	191
Bellefourche experiment farm, remarks	322
BENNETT, J. B., report as Appointment Clerk, 1910	897–916
Bethesda Experiment Station, work, 1910	274–277
Bibliography, botanical, study	307
Big boll cottons, experiments	292
Bighead, sheep, occurrence, description, studies	259–260
Bindweed, control, remarks	333
Biological investigations, miscellaneous	553–554
Survey, Bureau, appropriations, disbursements, and balance	571
cooperation in rat eradication in packing houses	269
with Bureau of Animal Industry	532
Public Health and Marine-Hospital Service	551
State game officials	561–562
cooperative study of spotted fever transmission by ticks	537, 538
force, number and classification	905
officers	915
outline of work for 1911	564–565
publications issued during year, new and reprints	662–663
report of Chief, 1910	549–565
review of work by Secretary	121–133
scope of work	549
Bird diseases, study	263
plumage, millinery use, note	130
protection, international committee	130
relation to protection of mammals	557–558
reservation, Hawaiian, depredations by plume hunters	558
reservations, National	557–558
remarks by Secretary	130
reserves, trespass, causes, etc	869
Birds, distribution and migration, studies	127
game, notes	560–561
importation, notes	128, 555–557
protection and increase for insect control	126
relation to fruit industry in California, investigations	553
gipsy and brown-tail moth, investigations	553
usefulness against codling moth, remarks	125–126
Bison range, National	130, 558–559
Bisulphid of carbon, use in fumigation in mills, etc	541
Black Hills beetle, control	522–524
Blackleg, cattle, prevention experiments	261
vaccine, preparation and distribution	261
Blepharipa, gipsy moth parasite, importation, 1909	516
Blight, coniferous seedlings, study	285
Blister rust, white pine	285
Blueberries, growing, studies	74–75
Blueberry, domestication and relation to acid soils	305
Boll weevil, control, studies and experiments in South	81–82, 83, 120
cotton, damage in 1910	518–519
investigations, work of Entomology Bureau	518–520
Bonds, preparation by Solicitor, work	886–888

Digitized by Google

Page.

Bordeaux mixture, comparison with other fruit-tree sprays 526
value as fungicide..... 54
Boston laboratory, food and drug inspection work, 1910..... 463–465
Botany, bibliography, study..... 307
Bovo-vaccination, tests and results..... 275
Boys' clubs, share in demonstration work..... 338
corn clubs, work in the South..... 82–83
Brandies, French, misbranding and relabeling requirements..... 457–458
Brandy, Cognac, misbranding, relabeling requirements..... 457–458
Bread making, flour substitutes, experiments..... 448
Breeding, animal, experiments and results, 1910..... 211–215
asparagus, note..... 287
cattle, Alaska, experiments, etc..... 750
cereal, experiments, Alaska..... 145
corn, cotton, etc., review of work..... 291–294
testing methods..... 315
horses, work of department..... 44
horticultural plants, Alaska, work..... 750
live stock, Porto Rico..... 147
plant, for cotton improvement, etc..... 323–325
investigations..... 288–290
stock, experiments, Alaska..... 145
tobacco, investigations..... 317
Bridges for highways, need of improvement..... 155
improvement, necessity..... 783–784
Bromus inermis, resistance to drought..... 324
Broom-corn stalks, value for paper making, note 62
Brown-tail moth, control, investigations..... 113
parasites imported..... 115–116
work of Entomology Bureau in various States..... 510–517
Bubonic plague, spread by rats, remarks by Secretary..... 121
Buckwheat, production per acre, variations for several years..... 711, 712
Bud-rot, coconut palm, studies 53, 231
Buffalo laboratory, food and drug inspection work, 1910..... 465
preservation of species 130
Building committee, leases, preparation by Solicitor..... 888
Buildings, Agriculture Department, appropriations, disbursements, and balance..... 569
for Department, expenditures and balance..... 568
rented by Department in District of Columbia, purposes, rental, etc..... 576
Bulbs, Congressional distribution..... 361
Dutch, production in America, work..... 86, 361–362
Bureau, Animal Industry, etc. *See* Animal Industry; Biological Survey; Chemistry; Entomology; Plant Industry; Soils; Statistics; Weather.
Butter, creamery, improvement..... 46
farm, inferiority, study of causes..... 238
flavoring matter, study of determination..... 238
inspection for Navy, work of Dairy Division, 1910 235
investigations, 1910..... 141, 237–238
manufacture from sour cream, detection methods, study..... 237–238
"metallic flavor," study 238
prices, creamery and factory receipts..... 21, 24
renovated, inspection, 1910..... 238, 241
need of legislation..... 210–211
testing for tubercle bacilli..... 277

Cactus, injury by insects..... 522
See also Prickly pear.
Caffein, pharmacological studies..... 446
California, apple storage..... 348
citrus groves, insect protection..... 117
fruit-tree insects, control investigations..... 525–526
grapes, pre-cooling experiments..... 349
ground squirrel. *See* Ground squirrel.

Digitized by Google

Page.
California, irrigation investigations, cooperative work 151
soil surveys, cooperation of State 498
Turlock Canal, losses by squirrels 122
Calorimeter, respiration, use in nutrition investigations 148–149
Calosoma sycophanta, European beetle, importation, increase, etc., 1910 ..... 116, 516
Calves, inspection, 1910 243–244
Camembert cheese, manufacture, experiments 240–241
Camphor investigations, review 59, 296
Canals, Fallon, Nevada, damage by gophers 550
Cancer cures, examination, results 442–443, 459
Cane, injury by *lachnosterna*, investigations 754
Carbolic acid, use in hog cholera control, study 271
Carbon, bisulphid, use in fumigation in mills, etc 541
Cardinals (redbirds), importations, difficulties, etc 556
Carob, value as stock feed, introduction, etc 356
Cassava investigations, remarks 334
Catalogues, Department Library, growth, work, conditions, etc 730–731
Caterpillar, New Mexico range, investigations 121, 530–531
yellow bear, control methods 533
Caterpillars. *See* Moths.
Cattle, bovo-vaccination, tests 275
breeding, Alaska, experiments, etc 750
methods, experiments, etc 214-215
diseases, investigations in Honduras by Animal Industry Bureau 255–256
District of Columbia, tuberculin test, requirements 50
feed, chemical examinations 480–481
feeding experiments in South 217–218
foods, adulteration, studies 456
Galloway, adaptability to Alaskan climate 750
inspection, 1910 ..... 48, 243–244
mange, control methods, studies 273
scabies, eradication, 1910 ..... 48, 206-207, 247
ticks, eradication work, 1910 ..... 47–48, 204–205, 246–247, 273–274
study, note 121
tuberculin tests, number reacting, etc 250–254
tuberculosis, eradication in District of Columbia 49–50, 207, 253–254
investigations by Animal Industry Bureau 207, 250–254, 263–264, 271, 275–277
tuberculous, disposal, reimbursement, etc., District of Columbia 49–50
Cauliflower, new spot disease, studies 53, 281
Cedar, red, cause of rust in apple 54, 282
rust on apple, prevalence, work, etc 54, 282
Celery investigations, remarks 341
Census figures, use in revision of crop estimates, remarks by Secretary 136
Cereal diseases, work, remarks 67, 312
plant-insect investigations 529–534
products, investigations 541
Cereals, composition, influence of environment, studies 448–449
nutritive value, studies 447
production and value, 1910 16
pure strains, production 310
rotation crops 65, 310
Charlock, use as substitute for mustard, study 451
Charts, ocean, description, publication, distribution, etc 181–182, 622
work of Weather Bureau, 1910 181–182
Cheddar cheese, work at Wisconsin Experiment Station, 1910 240
Cheese, American Cheddar, misbranding 458
dietary value, tests with calorimeter 149
skim-milk, branding 458
soft, investigations, 1910 240–241
whole-milk, misbranding 458
Cheese-making problems, investigations 47, 239–241
Chemical investigations, special work, 1910 447–453
reagents, examination 446–447
studies, forest products 413
Chemist, report of work of Chemistry Bureau, 1910 429–491

Digitized by Google

Page.
Chemistry Bureau, appropriations, disbursements, and balance..... 485, 570–571
contracts and leases, preparation by Solicitor..... 887
cooperation with Department of Justice..... 106
Plant Industry Bureau in fruit-products investigations..... 100–101
cooperative study of arsenic accumulations in soil..... 527–528
force, number, and classification..... 486, 904
officers..... 914
proposed work, 1910–1911..... 486–491
publications, 1910, new and reprints..... 485, 663–665
report of Chief, 1910..... 429–491
review of work by Secretary..... 98–107
Cherry, Chinese, early maturity, experiments..... 356
trees, Japanese, insect infestation, and destruction..... 542
Chestnut-bark disease, control methods..... 55
Chicago laboratory, food and drug inspection work, 1910..... 465–466
Chickens. *See* Poultry.
Chinese soil, comparison with American soil, studies, etc..... 502
Chlorosis, pineapple, study and control experiments..... 146
Cholera, hog, investigations, 1910..... 270–271
prevention by serum treatment, studies and experiments.... 50, 270–271
serum, studies in manufacture and use..... 50, 270–271
Cider, keeping methods..... 437
Ciders, composition, study of samples..... 452
Cigar tobacco districts, investigations..... 316–317
Cigarette beetle, tobacco, control studies..... 521
Cincinnati laboratory, food and drug inspection work, 1910..... 466–467
Citrus by-products, studies in California..... 437–438
fruit, breeding..... 288–289
improvement through bud selection, investigations..... 352
tumor disease, cause and remedy..... 53, 281
fruits, artificial ripening, investigations..... 437, 455
Florida, investigations..... 347
immature, picking and handling..... 455
insects, injurious, investigations..... 117–118, 534–536
trees, Congressional distribution..... 361
insect pests, investigations..... 754
Civil Service Commission, work by Office of Experiment Stations..... 748
Claim for salary, suit in Court of Claims..... 885
Claims, handling, violations of law..... 456
land, within National Forests, establishment, etc..... 366–369
mineral, within National Forests, establishment, etc..... 366
National Forest lands, work, settlements, etc..... 366–369, 874–877
Climatological Division, Weather Bureau, work, 1910, plans, etc..... 177–180
publications, new methods, etc..... 177–178
reports..... 622
Clinkers, Portland cement, use in road building, experiments..... 788–789
Clover management, Northern States..... 328
red, disease-resistant, experiments in Tennessee..... 85
production, studies..... 84–85
value as forage crop..... 83, 84–85
use in South, remarks..... 327
Coal-tar colors, use in food products, investigations..... 471–472
Coccidiosis, poultry disease, damage..... 216–217
Coccinellids, American, mulberry scale parasite, exportations to Italy..... 518
Coconut palm, bud rot, study..... 281
cultural possibilities..... 295
Codfish, spoilage, causes, losses, etc., studies..... 103, 435
Codling moth, control, work of Entomology Bureau..... 121, 125, 526–527
Coffee growing, investigations at Porto Rico station..... 147, 755
imports, value, 1910..... 18
prices, increase on import value..... 23, 25
trees, injury by ants, investigations..... 754
Coffee-leaf blight, control, note..... 754
Cognac brandy, relabeling requirements..... 457–458
Colleges, agricultural, growth of activities..... 142–143, 736–737

Digitized by Google

Page.
Colleges, agricultural, relation to Office of Experiment Stations 740–742
Colorado, biological survey, report to be published 126
cooperative investigations of truck-crop insects 533
horse-breeding experiments, 1910 211–212
Compsilura, moth parasite, importation, increase, etc 116, 516–517
Concrete, oil-cement studies, formula, and method of mixing 157, 790–791
use in road building, walls, floors, etc 790–791
Condensed-milk industry, cooperative study 456
Condimental foods, expensiveness, note 141
Congressional publications, Department of Agriculture, 1910 642–644
seed distribution 360–362
Connecticut, moth control, work of Entomology Bureau, 1910 ..... 113–116, 512–513
Conservation of natural resources, remarks by Secretary 139–140
Consumption cures, dangers in use, investigations, etc 443
Contagious diseases, animals, eradication, study 204–207, 246–248, 272–277
Contract supplies, examination by Chemistry Bureau 483–484
Contracts, Department, with beneficiaries of National Forests, preparation, scope, etc 873–874
preparation by Solicitor, work 886–888
Cooperative buying associations as remedy for high prices 26
Corn, breeding and adaptation 291
testing methods 315
clubs, boys', work in the South 82, 83, 338
commercial handling, remarks 308
composition, studies by Chemistry Bureau 448
cooperative demonstration work 337
growing and use in Guam 756
hybrids, disease resistance and increased yields 59
investigations, discussion 68, 314–315
production per acre, variations for several years 10–11, 27, 28, 710, 712
purchasing power of one acre, 1899 and 1909 ..... 719–720, 721–722
relation to pellagra, study 298
storage under commercial conditions, studies 63–64
sweet, environment and sugar content, studies 432
tillage needs and weeds 333
weed destruction, studies and experiments 81
Cornstalks, use in making feed for stock 302
Corrosion, iron and steel, laboratory studies, Public Roads Office 156–157, 789–790
Cotton, acclimatization and adaptation 57–58, 291–294
crop, 1910, value 11
cultural methods, studies 81–82, 290, 294
culture, extension in United States 58–59, 71, 323
damage by boll weevil, studies 81–82
diseases, investigations 286
dry-land plant, remarks 58
Egyptian, breeding and adaptation to Southwest 71, 323
growing in Egypt 294
on Indian reservations 290
exports, value, 1910 18
grades, official, preparation 61–62, 300–301
growing, experiments at Hawaii station 146, 751
perennial varieties, growing in Hawaii 146
production per acre, increase since 1886 ..... 27, 28
variations for several years 711, 712
purchasing power of one acre, 1899 and 1909 720–722
red spider, investigations and control methods 522
reports on crop, remarks 135
seed, Congressional distribution 361
effect on milk, study 239
standardization, discussion 300–301
varieties, investigations 56, 292
wilt-resistant, importance of distribution of new variety, work 56
Cotton-boll weevil. *See* Boll weevil.
Cotton-seed meal and hulls, effect on milk, study 239
feeding, danger, investigations and experiments 51, 265–266
use in bread making, composition, etc 449

Digitized by Google

Page.
Cowpea, cross with alfalfa, work ... 354
value as forage crop ... 84
Cowpeas, investigations ... 360
varieties, description, etc ... 84
wilt-resistant, importance of distribution of seed, work ... 56
Cows, tuberculin tests ... 264–265
Cow-testing association, work and results ... 46, 230, 233
Cranberry insects, control, work of Entomology Bureau ... 528–529
Cream, pasteurized, butter-making experiments ... 47, 237–238
sour, use of lime in neutralization of acidity ... 237–238
sweet, pasteurized, methods of butter making ... 237
Creameries, by-products, utilization, studies ... 235
Creamery investigations, 1910 ... 232, 234–235
Cresol, fungicide for grain smuts, value, note ... 67
Crop plants, acclimatization and adaptation, progress ... 57–58
Reports, monthly, changes ... 135–136, 696–699
plans for 1911 ... 699–700
rotation, cereal growing ... 65, 310
influence on dry farming, study ... 448
tobacco, experiments ... 316
utilization, study ... 300
Crop-condition reports, method of preparation ... 706–708
Cropping systems, study and experiments ... 79–80
Crops, annual, change to perennial in Hawaii and Guam, by acclimatization ... 146, 147
chief, acreage, yield, farm price and value, 1899 and 1909, table ... 717
production, estimates of value, etc., 1910 ... 10–16
per acre, variations for several years ... 27–28, 710–712
dates of planting and harvesting ... 137
diversification, remarks ... 336
reports and estimates, work of Statistics Bureau, 1910 ... 135–137
Southern field, insects affecting, work of Entomology Bureau ... 518–522
yield increase, value of farmers' cooperative demonstration work ... 81–82
per acre, increase since 1886, review by Secretary ... 27–28
relation to population and prices, discussion by Secretary ... 26–30
Cross-fertilization, wheat ... 294
Crown-gall, inoculation and study, remarks ... 53, 281
Culverts, improvements, necessity ... 155, 783–784
Cupressus glabra, new species of cypress in Arizona, note ... 411
Curculio, plum, spraying, work of Entomology Bureau ... 528
Cut-over lands, crops ... 328
Cypress, new species in Arizona, note ... 411

Dairy buildings, drawings, work of Dairy Division ... 242
cows, rations, note ... 140
Division, work, 1910 ... 229–242
farming investigations ... 45–46, 230–233
herd records, establishment ... 230
industry, work of Department ... 45–47
inspection, score card, value in milk improvement ... 46
manufactures, work, 1910 ... 234–235
products, analysis and examination ... 458–459
interstate shipment, need of legislation ... 210
investigations ... 47
by Chemistry Bureau ... 102–103
manufacture, laboratory studies ... 237
samples, examination, prosecutions, etc ... 459
testing by Chemistry Bureau for Animal Industry Bureau ... 459
Dairying, South, work of Animal Industry Bureau, 1910 ... 231–232
West, work of Animal Industry Bureau, 1910 ... 232
Dairyman, share of milk price ... 20–21, 24
Damping off of forest seedlings, control ... 56
Dasylirion texanum, sugar fructose content, studies ... 449
Date culture, establishment and progress ... 74, 289
Dates, ripening, note ... 142
Deer destruction by wolves, investigations ... 129, 560
Demonstration farms, establishment in Hawaii ... 753

Digitized by Google

Page.

Demonstration farms, irrigation with small water supplies..... 151
spraying, cooperative studies of cranberry growing..... 528–529
Work, Farmers' Cooperative, review..... 335–338
Demonstrations, field, work of Farmers' Institutes..... 144
Denatured alcohol, investigations by Food Inspection Laboratory..... 456–457
manufacture, studies by Chemistry Bureau..... 453, 456–457
Denver laboratory, food and drug inspection work, 1910..... 467
Department of Justice, cooperation with Agriculture Department in study of transportation law violations 248
Chemistry Bureau..... 106
Dermacentor venustus, spotted-fever-transmitting tick, study..... 537, 538
Dermatitis schambergi, skin disease, responsibility of joint worm..... 529–530
Desert flood, Utah and southern California..... 40
Detroit laboratory, food and drug inspection work, 1910..... 467–468
"Diabetic flour," value, studies..... 449–450
Diarrhea, white. *See* Coccidiosis.
Dike borers, destruction, methods..... 550–551
Dioscorea, study..... 298
Dips, animal, investigations, 1910..... 269–270
arsenical, cattle ticks, experiments 269–270, 273–274
cattle, formula..... 273
coal-tar, cattle ticks, experiments..... 273–274
injury to sheep, laboratory investigations..... 269–270
Disbursements, Agriculture Department, 1910 569
Division. *See* Accounts Division.
Disbursing agents, temporary special..... 569
Disease, skin, responsibility of grain mite..... 530
Diseases, animal, causes of condemnation of meat..... 200, 244
eradication work..... 47–50
scientific investigations..... 50–51
studies by Animal Industry Bureau..... 204–207, 246–248, 257–263, 271, 273–277
contagious, domestic animals, suppression..... 204–207, 246–248, 257–263, 271, 273–277
forest trees, investigations..... 394
live stock, studies in Porto Rico, Hawaii, and Honduras, 1910 255–257
poultry and other birds, studies..... 263
Disinfectants, animal, laboratory investigations..... 269–270
Distillery, alcohol, experimental, use in educational course, Chemistry Bureau..... 453
District of Columbia, bovine tuberculosis, measures for eradication..... 49–50
Diversification, crop..... 336
Division, Accounts; Publications. *See* Accounts; Publications.
Dolichos biflorus, note..... 86
lablab, note..... 86
Domestic Crop Reports Division, work..... 704–706
Douglas fir, Pacific Northwest, results of investigations..... 408–409
Drainage investigations, Experiment Stations Office..... 152
work, plans, etc..... 762–765
Drinks, "soft," medicated, examination..... 444
Drought, grains resistant, notes..... 312
resistance, physiology..... 324
resistant crops, breeding..... 323–325
Drug adulteration, inspection work of Chemistry Bureau..... 439–447
Inspection Laboratory, work, 1910..... 459–461
work, Chemistry Bureau, 1910..... 439–447, 461–478
investigations, Chemistry Bureau, 1910..... 439–447
plant investigations, plans for future work..... 299
review..... 59, 295–297
samples, examination by Chemistry Bureau, 1910..... 440
in branch laboratories, 1910..... 461–463, 454–455
Drug Inspection Laboratory..... 459–461
Drug-addiction cures, investigation..... 459
so-called, investigation..... 444
Drug-habit cures, investigations..... 440
Drugs, adulteration, examination of samples, etc..... 459–461

Digitized by Google

Page.
Drugs and Food Act, enforcement by Department 32–33
violations, convictions, and fines 32
crude, importations, improvement under inspection 470
domestic, investigations 105
habit-forming, cures and dangers, investigations 461
imported, adulteration, lessening of practice 460–461
and domestic, examination by Chemistry Bureau 98–99, 104–105
misbranding, lessening of practice 460–461
inspection and research 104–106
misbranding, examination of samples, etc 459–461
various kinds, research work 105–106
Dry farming, experiment stations, work 140
influence of crop rotation, cooperative studies 448
Dry-land agriculture, investigations 69–71, 319–320
forage crops, experiments 360
grain investigations 66, 311
Ducks, wild, food investigations 352–353
Durra, production in drought, note 312
Durum wheat, investigations, remarks 309
production, notes 65
Dust preventives, experimental work of Public Roads Office 784–786
investigation 156
Dusting, comparison with spraying in fruit insect control 526
Dutch bulbs, production in America 86, 361–362
Dysentery, chronic bacterial, in cattle, studies 258–259

Earthquakes, instruments for recording, installation 176
Editor, report, 1910 621–694
Editorial Division, Bureau of Statistics, work 702–704
work, amount and character, 1910 631–633
Education, agricultural colleges and schools, development of work, etc 740
relation of Office of Experiment Stations 739–745
Egg industry, desiccated and frozen, cooperative studies 433–434
production, experiments in hybrid poultry breeding 216
products, interstate traffic, studies, prosecutions, and convictions 455
Eggs, cold-storage, investigations by Chemistry Bureau 217
desiccated, studies by Chemistry Bureau 102, 450
deterioration, studies by Chemistry Bureau 429, 431–432
handling, investigations by Chemistry Bureau 101–102, 217
production and handling, investigations 44–45
tern, importation under false name, action of Departments, etc 556
Egyptian cotton. *See* Cotton, Egyptian.
Employees, Agriculture Department, appointments, promotions, removals, etc 897–916
pay-roll classification 908
Engineering, highway, instruction in Public Roads Office 154, 786
Enological-chemical studies 451–452
Entomologist, report, 1910 509–548
Entomology Bureau, appropriations, disbursements, and balance 571
classification of work, 1910 509
contracts and leases, preparation by Solicitor 887
cooperative study of insecticides and fungicides 479–480
force, number and classification 905
minor lines of work, general statement by Secretary ... 120–121
officers 914
proposed work, 1911, 1912 546–548
publications, increase 546
issued during year, new and reprints 666–670
report of Chief, 1910 509–548
review of work by Secretary 113–121
Enzyms, study, Chemistry Bureau 445, 449
Epilepsy cures, fraudulent claims, investigations 443
Estimates, 1912, variation from 1911 132
Eucalypts, growing in Florida, investigations 409
planting in National Forests, experiments 389
yield from plantations, study 409

Digitized by Google

Page.

Eucalyptus seedlings, damping off, prevention 285
Eulalia japonica, investigation as paper plant, note 301
Europe, nursery-stock inspection, studies 543
Evaporation, cooperative studies by Weather Bureau and Forest Service 180
studies, Salton Sea and other stations 41, 178–180
Weather Bureau, 1910 178–180
Expenditures, Agriculture Department, 1910 568
annual report, summary 589
Forest Service, classification 363–364
Experiment farms, several, remarks on each 321–322
Station Record, scope of work 746–747
work, publication, need for suitable agency 737–739
stations, forest, work, results, etc 390–392
insular, work, etc 748–757
Office, appropriations, disbursements and balance 572
contracts and leases, preparation by Solicitor ... 887
force, number and classification 907
officers 916
publications issued during year, new and reprints 670–676
relation with experiment stations 735–739
institutions for agricultural education 739–745
report of Director 735–766
review of work by Secretary 138–152
State, extension of work by substations, etc 140
publications, notes 139
Experimental farm, Arlington, review of work 73, 339–343
new, Beltsville, Md., purchase, uses, etc 53, 208
Experiments, data, need of agency for publishing 737–739
Explorations, southeastern Asia, plant resources 77–78
Exports, farm products, per cent of total domestic exports 18
forest products, value, 1907 and 1910 19
meat-inspection certificates issued, 1910 245
Extension work, agricultural, and farmers' institutes 143–144
Extracts, beef, analyses by Chemistry Bureau 449
meat, preparation, rules governing 263
root-beer, investigations 441

Fallow, notes on experiments 321
Farm acreage, increase in value of products 28–30
Arlington experimental, work, progress 73
drainage, surveys 762–763
equipment, study 331
experimental, new, at Beltsville, Md., purchase, uses, etc 53, 208
labor, wages, investigations by Bureau of Statistics 701
management, investigations, review 79–85, 325–335
Northern districts, study 79–80, 328–330
Southern, methods, cooperative studies 79
Western, methods, study, and experiments 80
organization and operation, study 80, 331
practices, study and experiments 79–81
prices, relation of population and crop yields 26–30
problems, study 330–335
products, exports and imports 18
foreign trade, investigations by Bureau of Statistics 701
increase in purchasing power 29
perishable, handling 157
prices, discussion by Secretary 19–26
work of Division of Production and Distribution 700
value, 1910, increase over previous years, comparisons, etc. 9–10, 16–17
1910, yield and value, comparison with previous years 16–17
See also Agricultural products.
Farmer, share of high prices 19–24
Farmers' Bulletins, appropriation, cost, etc 624–627
growth, Congressional distribution, demand, etc 134, 625–627

Digitized by Google

Page.
Farmers' Bulletins, issued 1910, titles, numbers, etc. 625–626
output and cost, 1907–1910. 625
Cooperative Demonstration Work, review. 81–83, 335–338
effect of increased cost of living. 716–717
income per acre, increase with high prices. 28–30
Institutes and extension work. 742–748
for women. 144
young people. 144
review of work. 143–145
prices, comparison with consumer's prices. 19–26
supplies, prices in 1899 and 1909, comparison. 718–719
purchasing power of acre of corn, wheat, or cotton, 1899 and 1909. 719–722
quantity purchasable with 1 acre of corn, wheat, or cotton in 1899 and 1909. 719–722
Farming, diversified in North Dakota, remarks. 329
types, study. 329
Farms, demonstration, establishment in Hawaii. 753
Fat, hog, effect of feeding cottonseed meal, study. 268
Fats, action on metals, laboratory studies. 268
hardness, apparatus for testing, invention and use. 239
rancidity, laboratory studies. 267
Feed, cattle, chemical examinations. 480
effect on composition and properties of milk, cooperative experiments. 239
Fencing, wire, protection by painting. 156, 789–790
rusting, investigation. 156, 789–790
Fertilizer, truck crop, experiments. 341
use of nitrogen. 502
Fertilizers, commercial, farm practice, study. 81, 334
home mixing, study and experiments. 79–80
cotton, experiments. 751
effect on pineapples, note. 142
influence on plant growth, studies by Soils Bureau. 506
rice growing, experiments. 752
study, remarks by Secretary. 140
tobacco, experiments. 316
use of phosphates. 502–503
Fever, spotted, relation of ground squirrels, investigations. 549–550
transmittal to human beings by ticks, cooperative studies. 537, 538
Fiber investigations, review of work by Secretary. 62–63
Fiber-plant investigations, remarks. 62–63, 303
Fibers, vegetable, imports, value, 1910. 18
Fig, breeding and study. 289
self-sealing, remarks. 289
Figs, growing, investigations, review of work by Secretary. 74
imported, laboratory study of condition. 450, 457
Finances, Agriculture Department, 1839–1910. 591–619
Fir, Douglas, Pacific Northwest, results of investigations. 408–409
Fire protection, National Forests, legislation, recommendation. 95
needs, methods, etc. 91–95
Fires, forest, losses in 1910. 90
protection in National Forests. 88–95
National Forests, distribution, extent, and damage. 88–91
loss of human life. 90
losses, causes, preventive measures, etc. 90–91, 375–379
Fireweed, oil, importance, note. 297
Fish, canned, analysis and testing. 464
effect of tin corrosion. 458
deterioration, studies. 449
investigations by Chemistry Bureau. 103
salt, spoilage, causes, losses, etc. 435
See also Codfish.
Flavors, butter, study. 238
Flax, growing for fiber and seed, remarks by Secretary. 63
investigation, remarks. 303
Flaxseed crop, 1910, yield and value. 15

Digitized by Google

Page.
Flaxseed, storage under commercial conditions, changes, studies..... 64
Flea-beetle, tobacco, control investigations..... 520
Fleas, disease-spreading, relation to bubonic plague..... 122
Floods and rivers, work of Weather Bureau..... 40
1910, amount of damage..... 173–174
various States, extent and losses, 1910..... 40, 173–174
Floricultural investigations, need..... 342
Florida, citrus fruits, insects affecting, investigations..... 117–118, 534–535
investigations..... 347
mango growing, importance..... 77
Flour beetles, investigations..... 539
bleached, investigations..... 104
laboratory investigations by Chemistry Bureau..... 104, 455
prosecutions, decisions, etc..... 455, 465, 466, 475, 798
"diabetic," value, studies..... 449–450
mills, infestation by beetles and moths, investigations..... 539–540, 541–542
moth, Mediterranean, investigations..... 539–540
pharmacological studies..... 445
substitutes in bread making, experiments..... 448
Flours, Maryland, study of baking qualities..... 447
Flower seeds, Congressional distribution, demand, award of contract for packing, etc..... 360–361
Fly, Hessian, investigations..... 530
house, control studies, Entomology Bureau..... 537
white, control, experiments in Florida..... 534–535
Flycatchers, economic value of the bird, investigations..... 553
Food adulteration, detection methods, studies..... 439
and drug inspection, laboratory work, 1910..... 453–478
Drugs Act, administration..... 32–33, 796–846
forms of procedure..... 797
samples, investigations by Chemistry Bureau..... 451
violations, convictions, and fines..... 32, 794, 796–846
containers, investigations..... 103–104
Inspection Laboratory, work, 1910..... 434–435, 453–478
work, Chemistry Bureau, 1910..... 434–439, 456–458, 461–478
investigations, Chemistry Bureau..... 99–104, 429–439
prices, relation to wages, factor in increased cost of living..... 716–722
products, American, testing methods in foreign countries..... 439
contamination by tin cans, investigations..... 438–439, 458, 464
use of coal-tar colors, investigations..... 471–472
samples, examination in branch laboratories..... 439, 454–458, 461–463
testing by Chemistry Bureau for various departments..... 439, 459, 464, 466, 467, 469, 472, 476, 477, 478, 479
supply, wholesome, study by Agriculture Department, importance..... 31
Foods, canned, influence of tin receptacles..... 438–439, 458, 464
import cases, investigation by Food Inspection Laboratory..... 457
imported and domestic, collection and examination by Chemistry Bureau..... 98–99
in storage, deterioration, study by Chemistry Bureau..... 429–432
Forage crops, drought-resistant, needs of semiarid regions..... 86
dry-land, experiments..... 360
Guam experiment station, work..... 756
investigations..... 83–86, 358–360
new, studies and experiments..... 83–86
National Forests, investigations..... 402–404
production, study..... 334
Forage-plant insect investigations..... 529–534
Forecast cards, number issued annually..... 622
Forecasts and warnings, distribution, results, and press notices in various cities, 1910..... 38–40, 166–172, 185–187
extended periods, work of Weather Bureau, 1910, notes and comments..... 169–172
weather, work of year, review by Secretary..... 38–40
Foreign seed and plants, inspection against insects..... 120
introduction, work..... 355–360
trade, agricultural products..... 17–19

Digitized by Google

Page.
Foreign trade, balance in favor of farm products 17
farm and forest products, investigations by Bureau of Statistics 701
Forest cover, effect on stream flow, studies 392–393
entomology, cooperative work and results 522–524
fires, protection, cooperation of railroads with Forest Service 91
grazing areas, improvement 304
insects, injurious, control, investigations 118–119, 522–524
lands, National, claims and settlement 366
open to entry, speculation, danger 365
management, National Forests 375–379
pathology, investigations 55–57, 285–286
preservation, studies and proposed work 97–98
products, exports and imports 19
foreign trade, investigations by Bureau of Statistics 701
injury from insects, cooperative investigations 522–524
investigations, cooperation, etc 97–98, 411–416
resources, studies, cooperation of various States 98
Service, accounting, transfer to Division of Accounts and Disbursements 133
appropriation, disbursements, and balance 572
business organization 374–375
contracts, leases, and bonds, preparation by Solicitor 887
cooperation with Entomology Bureau in disposition of beetle-infested timber 524
other Departments, States, etc .. 89, 90, 91, 97–98, 406
railroads in fire protection 91
cooperative study with Weather Bureau of forest effects on stream flow, etc 174–175, 180
work in barkbeetle control 524
cost and use 370–373
evaporation studies, cooperation with Weather Bureau 180
expenditures and receipts 363–364, 370–371
fiscal affairs 586–588
force, number, and classification 373–374, 903
law work, administration, etc 33, 34–35, 795, 870–871
legal work by Solicitor 33, 34–35, 795, 870–871
officers 911–913
plans for coming year 419–427
publications issued during year, new and reprints 677–680
report of Chief, 1910 363–427
State and private cooperation 406–408
work, miscellaneous 419
review by Secretary 86–98
trees, destruction by insects, notes 118
Forester, report, 1910 363–427
Forestry Bureau. *See* Forest Service.
Forests, injury from insects, cooperative investigations 522–524
National, area 364–366
disease studies 285–286
enforcement of laws 34–35, 369–370
expenses of administration, protection and improvements. 88, 90, 92, 93
fire protection, increase of appropriation, recommendation 95
fires, distribution, extent, and damage 88–91
permanent improvements 405–406
protection from disease 400–401
fire, methods 91–95
range management 96–97
reforestation, progress and proposed work 87–88
timber sales, policy, prices, etc 95–96
stand and cut of year 86–87
uses and value 95–96
reproduction, effect of cutting 391–392
thinning, effect on growth and quality of timber, studies 393
France, inspection against insects, note 120

Digitized by Google

Page.
Freight charges on farm produce 20, 21, 23, 25
Fruit, by-products, laboratory studies 451–452
disease investigations, review 53–57, 282–284
districts, investigations 351
garden, dry-land, progress, etc 351
growing in National Forests, work 351
on reclamation projects, note 171
industry, California, relation of birds, investigations, note 553
investigations, work on dates and figs 73–74, 289–290
marketing investigations 75–76, 344
nomenclature and identification, study 343
precooling experiments 349
products, experimental work, Chemistry Bureau 436–438
investigations 99–101
storage investigations 75–76, 345, 347
transportation studies, remarks 75–76, 344
trees, insects injurious, investigations 524–529
varieties, adaptability to environment 351
washing, experiments 347
wormy and unsound, investigations by Chemistry Bureau 99
Fruits, Alaska, experiments 750
citrus, immature, picking and handling, methods 437, 455
insects injurious, investigations 534–535
experimental work, Chemistry Bureau 99–101, 436–438
exports and imports, value, 1910 18
from Asia, introduction 78
Guam experiment station 757
small, study of diseases 284
surplus, utilization 344
varietal studies at Arlington farm 343
Fumigation, citrus fruit trees, experiments 534–536
control of Mediterranean flour moth 539–540, 541–542
experiments in white fly control 534–535
flour mills, etc., for control of flour moth 539–540, 541–542
hydrocyanic-acid gas, improvement of method 117
rice mills, investigations 540
Fungi, Guatemalan, collection, note 282
relation to plant diseases, notes 281
Fungicide, self-boiled lime-sulphur, value to peach growers, demonstration 54–55
Fungicides, examination by Chemistry Bureau 106, 479–480

Galveston laboratory, food and drug inspection work, 1910 468
Game, big, distribution, etc 560
importations, 1910 ..... 128, 555–557
interstate commerce 130, 562–563
laws, enforcement 35, 868–869
legislation, index, note 561
officials, directory, note 561
preservation and introduction, discussion by Secretary 128
preserves, National Forests 404–405
protection, Alaska 129, 559–560
work of Biological Survey, and plans 128, 555, 559, 565
Gardens and Grounds, Department, maintenance and operations 353–354
school, remarks 342
Garriott, Edward B., Weather Bureau, death, notice 194
Gas, hydrocyanic-acid, use in disinfecting mills, warehouses, etc 540–542
fumigation in California 536
Geological Survey, United States, cooperative study of phosphates 502–503
Georgia, irrigation experiments 152
peaches, precooling experiments 349
Gid, sheep, investigations 207, 272
Gipsy moth, control investigations 113
Parasite Laboratory, parasite importations, work, 1910 ..... 115–116, 514–518
relation of birds 553
work of Entomology Bureau in various States 510–517
Glanders, horses, cooperative inspection 247
determination methods, studies 260

Digitized by Google

Page.
Glucose, laboratory studies ... 433
nutritive value for animal food, experiments ... 449
Glycerin, determination in meat preparations ... 449
Goat breeding, methods, investigations ... 213
Goats, inspection, 1910 ... 243–244
Gophers, destruction, methods ... 550
Graduate School of Agriculture, fourth session, remarks by Secretary ... 143
Grain and grain products, exports, value, 1910 ... 18
aphis, investigations ... 529
composition, influence of environment ... 65, 310
crops, plans for study ... 314
experiments in southwestern plains ... 310
feed for cattle, investigations ... 480
investigations, dry land ... 311
review ... 65–67, 309–315
marketing and transportation, study ... 137
on the Pacific Coast, investigations by Bureau of Statistics ... 700–701
sorghum investigations, remarks ... 312
standardization, review of work ... 63–64, 308
trade of the Great Lakes, investigations by Bureau of Statistics ... 700
weeviled, effects on human beings and live stock, investigations ... 541
See also Barley; Corn; Oats; Rye; Wheat.
Grains, seeding, time and rate ... 65–66, 311
Grape, by-products, laboratory studies ... 451–452
cultivation, investigations ... 76, 350
diseases, study ... 284
growing, Pacific Coast, investigations ... 76, 350
insects, studies of Entomology Bureau ... 527
investigations, Sandusky, Ohio ... 451–452
juice, studies ... 436–437
root-worm, studies of Entomology Bureau ... 121, 527
rotundifolia, investigations ... 76, 350
Grapefruit, immature, picking and handling, study of methods ... 437, 455
Grapes, experiment stations studies ... 141–142
storage investigations ... 345
table, transportation studies ... 344
Grass seed, Congressional distribution ... 361
Grasses, economic, study of botany ... 305
new, experiments ... 359
studies of varieties in the South ... 85–86
GRAVES, HENRY S., report as Forester ... 333–427
Grazing Branch of Forest Service, plans for future work ... 424
lands, mountain, reseeding, results of investigations ... 73
National Forests, advisory boards ... 397
capacity, permits, and receipts ... 96, 97, 370–371, 395
trespass cases, decisions ... 396–397
permits, National Forests, decrease in number issued, receipts, etc ... 96, 97
plants, relation to acidity of soils ... 305
reconnoissance, National Forests, investigations ... 402–404
trespass, National Forests ... 396–397
use of State and private lands ... 399–400
Great Basin, soil surveys, cooperation of States ... 498
Britain, tuberculin tests, 1910 ... 250
Lakes region, resources, value of soil surveys, etc ... 109
Plains agriculture, investigations and experiments ... 69–70
dry-land agriculture, studies ... 447
fruit growing, investigations ... 351
irrigation in connection with dry farming, work ... 760
reconnoissance surveys, 1910 ... 498–501
soil-water investigations, scope, value, etc ... 110–111
Green bug, investigations ... 529
Greenhouse crops, diseases, control, note ... 142
work, Arlington Experimental Farm ... 339
Greenhouses, Department, changes, maintenance, and operations ... 76, 352–353
Ground squirrel, control, measures, and investigations ... 122–124
disease spreading, relation to plague ... 122
poison effective in destruction ... 123

Digitized by Google

Page.
Ground squirrel. *See also* Squirrels.
Ground-water supply, importance in dry farming ... 506–507
Guam, agricultural development ... 148
Experiment Station, purchase of leased land, work, etc ... 755
review of work by Secretary ... 147–148
work ... 755–757
Guinea pigs, inbreeding experiments at Bethesda, Md., experiment station ... 215
Gypsy. *See* Gipsy.

Haarlem oil, misbranding, investigations by Chemistry Bureau ... 460
Harvesting crops, dates, investigations by Bureau of Statistics ... 701–702
Hatch fund, use by stations, criticism ... 736
Hawaii Experiment Station, work ... 751–753
review by Secretary ... 145–146
live-stock diseases, control studies, 1910 ... 255
Hawaiian bird reservation, protection ... 130
Hay, crop, 1910, value and yield ... 11–12
curing, artificial drying, southern farm practice ... 81
drier, artificial, construction by Agriculture Department ... 81
investigations, remarks ... 333
production per acre, variations for several years ... 711, 712
Headache remedies, dangers, etc., investigations ... 441–442
Health, protection by control of rats, fleas, etc ... 121–122
Public, and Marine-Hospital Service, cooperation with Biological Survey ... 551
Bureau, proposed establishment, discussion ... 202–204
objections, discussion by Secretary ... 30–32
Hemp investigations, remarks ... 62–63, 303
Henshaw, H. W., report as Chief of Biological Survey ... 549–565
Hessian fly, investigations ... 530
Highway engineering, instruction, Public Roads Office ... 154, 786
Highways. *See* Roads.
Hog cholera, investigations, 1910 ... 270–271
serum, manufacture and use, studies ... 50, 270–271
fat, effect of feeding cotton-seed meal, study ... 268
Hogs, bovo-vaccination, tests ... 275
feeding experiments ... 218
inspection, 1910 ... 243–244
serum treatment for prevention of cholera, efficiency ... 50
Holstein cattle, breeding experiments ... 214
tuberculosis tests and experiments in North Dakota ... 214
Homesteads, National Forest lands ... 366–369
Hominy, feeding value, experiments at State College, Pennsylvania ... 217
Honduras, cattle-disease investigations by Animal Industry Bureau ... 255–256
live-stock diseases, studies, 1910 ... 255–257
Honey, imported, analyses, number and value ... 432–433
Hopi cotton, value and improvement ... 292
Hops, crop 1910, probabilities ... 15
investigations, remarks ... 59–60, 297
Hornworm, tobacco, control studies and experiments ... 520–521
destruction by parasites, investigations ... 518
Horse breeding, study and experiments in various States ... 208, 211–212, 219–229
work of Department ... 44
Horses, breeding for United States Army, cost, etc ... 45, 208, 219–229
carriage, American, classification ... 212
glanders, cooperative inspection ... 247
determination methods, studies ... 260
number in United States, 1910 ... 221
scabies, control methods ... 247
swamp fever, studies by Animal Industry Bureau ... 257–258
Horticultural investigations, review ... 340–343
House fly. *See* Fly, house.
Howard, L. O., report as Chief of Entomology Bureau, 1910 ... 509–548
Humid regions, irrigation in times of drought ... 152
Huntley Experiment Farm, remarks ... 322

Digitized by Google

Page.
Hurricanes, destructive, 1909, warnings by Weather Bureau ... 39
1910, warnings of Weather Bureau, notes and comments ... 166–169
Hybridization, plant, work ... 354
Hybrids, cotton, investigations ... 294
zebra-ass, breeding experiments ... 44
Hydrocyanic-acid gas fumigation, improvement ... 117
use in disinfecting mills, warehouses, etc ... 540–542
fumigation in California ... 536
Hydrogen peroxid, study of keeping qualities ... 440

Idaho, crop yield under limited irrigation ... 151
forest protection from insects ... 119
irrigation investigations, cooperation ... 151
Illustrations, work of Publications Division, 1910 ... 634–736
Implements, farm, prices, 1899 and 1909, comparison ... 718–720
quantity purchasable with one acre of corn, wheat, or cotton in 1899 and 1909 ... 719–722
Importations, Japanese cherry trees, insect infestation, and destruction ... 542
mammals and birds ... 555–557
moth enemies, work of Entomology Bureau, 1910 ... 514–518
Imports, farm products, increase in quantity and value ... 18
Indian reservations, cattle testing by Animal Industry Bureau ... 254
cooperative work in agriculture ... 290
Index, card, of experiment station literature, work, condition, etc ... 747–748
Indexing, work of Publications Division ... 633–634
Industrial Commission, investigation of high prices ... 21, 24
Ink, branding, meat-inspection work, quantity and cost ... 269
Insect inspection and quarantine law, necessity ... 543
investigations, divisions of work ... 113
Insecticide investigations ... 106, 528
Insecticides, examination by Chemistry Bureau ... 106, 479–480
experiments in white-fly control ... 534–535
Insects, affecting southern field crops, work of Entomology Bureau ... 518–522
vegetable crops, investigations ... 532–534
cereal and forage-plant, work of Entomology Bureau ... 529, 534
control, measures and investigations ... 113–121
forest, investigations ... 394
injurious to citrus fruits, investigations ... 534–536, 754
crops in Hawaii, investigations ... 753
deciduous fruit trees, investigations ... 524–529
forests and forest products, control investigations ... 522–524
stored products ... 539–542
injury to cactus, investigation ... 522
relation to health of man and domestic animals ... 536–539
rice and sugar-cane, damage, annual loss in various States ... 521
investigations ... 521
specimens, determination, work of Entomology Bureau, 1910 ... 546
sugar-cane, investigations ... 521
tobacco, control investigations ... 520–521
useful, exportations ... 518
importations, 1909–10 ... 514, 518
Inspection, animals, export and import ... 51–52
number and kind ... 199–202, 243–244, 248–250
food and drugs, work of Chemistry Bureau ... 453–478
insect control, cooperation of States, Treasury Department, and railroads ... 119
insects and nursery stock, need of Federal legislation ... 543
law, National, insect pests, necessity ... 543
meat, work of Animal Industry Bureau, 1910 ... 42–44, 199–202, 242–246
moth, measure against gipsy and brown tail moths ... 114
renovated butter, scope of work ... 238, 241
State, aid in insect control ... 119
work, Chief, Division of Accounts and Disbursements ... 589–590
Inspector, Department, suit brought in sheep dipping case, status ... 886
Inspectors, food and drugs, duties, changes and work, 1910 ... 454
Instrument Division, Weather Bureau, work, 1910 ... 175–177

Digitized by Google

Page.
Instruments, weather, new work, 1910 175–177
Insular agricultural experiment stations, review of work by Secretary 145–148
experiment stations, work, etc 748–757
Interior Department, cooperation with Forest Service 406
cooperative studies of glanders in horses 247
Iron, corrosion, laboratory studies, Public Roads Office 156–157, 789–790
Irrigated lands, drainage surveys 763
Irrigation canal, break by ground squirrels, and losses 122–124
demonstration farms, small water supplies 151
humid region, study 152
investigation work, plans for future, etc 150–152, 757–762
rice, study 151
use of power, studies 760
water available, studies by Weather Bureau 174

Japan clover, use in South 327
cooperation with Agriculture Department in importation of moth parasites 515, 516
gift of cherry trees to United States 542
Johne's disease, cattle, studies 258–259
Johnson grass, eradication, remarks 333
Jointworm, investigations 529–530
Juice, fruit, treatment, studies 436–437
Juices, fruit, manufacture, laboratory studies 451–452
Jujubes, drought-resistant Chinese fruit, proposed experiments 79

Kafir, pink, drought-resistant forage crop, studies 86
production in drought, note 312
Kansas City laboratory, food and drug inspection work, 1910 468–469
Kentucky quarantine, sheep scabies, cooperation of State 48
scabies in sheep, quarantine establishment 206, 247
tobacco investigations 318
Ketchup, manufacture, studies by Chemistry Bureau 450–451
tomato, preservatives, studies by Chemistry Bureau 436
Kharkov wheat, winter variety, note 65
Kiosks, weather, installation, value, etc 175
Kite flights, Mount Weather Observatory, weather conditions governing 162
Kites, use in upper-air observations 37, 38, 161–164
Klamath experiment farm, remarks 322
Kowliang, production in drought, note 312

Labor, farm, wages, investigations by Bureau of Statistics 701
Laboratories, branch, food and drug inspection work, 1910 461–478
research, study of dairy products 237
seed-testing, discussion 307
Laboratory, forest products, cooperation with University of Wisconsin, work 412–414
Gipsy Moth Parasite, importation of moth parasites, work, 1910 514–518
investigations, Soils Bureau, 1910 501–503
plant pathology, lines of work 281–282
soils, investigations, progress, scope, and value 111–112
work, grape and apple 451–452
poultry and egg investigations 429–432
sugar and sugar products investigations 432–433, 456
Lacey Act, constitutionality, decision, importance 35
violations, cases, etc 868–869
Lachnosterna, injury to cane, investigations 754
Land claims, National Forests, disposal by Solicitor 34
logged-off, clearing methods 81, 335
Office, United States, cooperative study of phosphates 502–503
Lard, neutral, use in renovated butter, study 238
Larkspur poisoning, remarks 298
Law work of Department, review 33–36, 793–796
Laws, National Forests, enforcement 34, 369–370, 795–796, 894
Lead arsenate, use in boll weevil control, experiments 519–520
tobacco hornworm control 520
Leaf-hoppers, investigations 531–532

Digitized by Google

Page.
Leaf-roller, strawberry, studies 533
Leases, preparation by Solicitor, work 886–888
Leather, testing, Chemistry Bureau 481–482, 483
Legal decisions on important cases, relating to Department 34, 35
instruments, preparation work 886–888
Legislation, dairy products, shipment, need 52, 210
game, index, note 561
insect inspection, efforts and status 120
live-stock transportation, need 52, 210
need by Department 52–53
renovated butter inspection, need 53, 210–211
vaccines, serums, etc., control, need 52, 209
Legumes, beneficial effect on near-by crops, note 140
drought-resistant, experiments in semiarid regions 86
resistant to root-rot, experiments 360
Leguminous crops, growing in Hawaii, note 752
plants, Guam Experiment Station, experiments 756
Lemon groves, protection from insects 117–118
Lemons, coloring process, remarks 299
storage investigations 347
transportation 346
Leptilon canadense, oil, importance 297
Lespedeza, use in South, note 327
Librarian, report, 1910 723–734
Libraries, agricultural section, steps toward organization 733–734
Bureau and Division, growth, etc 732–733
Library, appropriations, disbursements, and balance 569
Association, American, annual conference discussion of agricultural libraries 733–734
Department, accessions 727–728
catalogue cards added 732
force, number, and classification 906, 915
foreign exchanges 726–727
growth, need of room 723–724
mailing lists 726
periodicals, receipt and circulation 728–729
publications during year 680
report of Librarian 723–734
review of work by Secretary 137
use of books, 1906 to 1910 724–725
Public Roads Office, work, 1910 791–792
Weather Bureau, additions and work, 1910 183–185
Lightning, White House protection, Weather Bureau plans 176
Lime phosphates, use as fertilizer, value, etc., cooperative studies 502–503
use in neutralization of cream acidity 237–238
Lime-sulphur spray, use on apples, etc 283–284
washes, experiments 528
Lime-sulphur-arsenate-of-lead, use in destruction of potato beetle 532
Lip-and-leg ulceration of sheep (necrobacillosis), control methods 49, 206, 248, 257
sheep, transmissibility to other animals 257
Litigation, general, cases reported to Attorney General, etc 877–884
Live stock, diseases, Porto Rico, Hawaii, and Honduras, 1910, studies 255–257
marketing on Pacific Slope, investigations by Bureau of Statistics. 700–701
National Forests, protection from wild animals and poisonous plants 402
Porto Rico, improvement, experiments 755
quarantine acts, violations, cases, etc 794, 856–864
transportation laws, violations, regulations, etc 248, 817–868
need of additional legislation 210
Live-stock industry, National Forests, important changes 396
Loco-weed investigations, remarks 297
Logged-off land, clearing, investigations 81, 335
stump-burning methods 81
Long-staple cotton, varieties and improvement 293
Louisiana laboratory studies, insects of cotton and rice 519–522

Digitized by Google

Page.
Maine, moth control, work of Entomology Bureau, 1910..... 113-116, 511-512
poultry breeding and feeding, studies..... 215-216
Mallein, use in glanders control, preparation and distribution by Animal Industry Bureau..... 51, 271
Malt, composition and preparation, studies by Chemistry Bureau..... 448, 453
Mammalogy, economic, plans for future work..... 564
Mammals, importations..... 555-557
Manganese, injury to pineapple growing..... 752
Mange, cattle, control methods and experiments..... 273
Mango growing, Florida and Porto Rico, importance..... 77
industry, development..... 358
Maple products, investigations..... 99-100
sirup, adulterations, investigations..... 432, 456
sugar, adulterations, investigations..... 432, 456
Marine Division, Weather Bureau, work, 1910..... 41-42, 180-183
Marine-Hospital Service, cooperation in publication zoology index-catalogue. 274
with Biological Survey..... 551
Marketing fruit, investigations..... 75-76
Marsh lands, drainage surveys..... 762
Maryland, Beltsville, new experimental farm, purchase, uses, etc..... 53, 208
tobacco investigations..... 318
Massachusetts, cooperative importations of moth parasites..... 514-518
moth control, work of Entomology Bureau, 1910.... 113-116, 510-511
McCabe, Geo. P., report as Solicitor..... 793-895
Meal, cotton-seed, effect on milk, study..... 239
feeding investigations..... 51, 239, 265-266
use in bread making, composition, etc..... 449
Meat, condemnation, 1910, causes..... 244, 245
extracts, preparation, rules governing..... 268
imported, inspection, proposed work, etc..... 457, 466
inspection appropriation, 1910..... 199
cooperative work with customs officials..... 457
laboratory work, 1910..... 199-202, 266-269
law, violations, cases..... 794-795
laws, enforcement..... 35, 794-795
methods, discussion..... 200
number of establishments and places where conducted, 1891-1910..... 242-243
relation to animal husbandry..... 31
scientific commission, report..... 200-201
State, need of legislation..... 202
preparations, medicinal, glycerin determination, studies..... 449
prices, data, work of Division of Production and Distribution..... 700
products, condemnation, 1910, causes..... 244, 245
inspection, cooperative work with customs officials..... 457
laboratory work, 1910..... 267-269
preparation under supervision of Animal Industry Bureau, 1910..... 244-245
Meat-inspection amendment, violations, cases, etc..... 864-868
law, application and exemptions..... 245-246
work, Animal Industry Bureau.... 42-44, 199-202, 242-246, 266-269
Meats, canned, effect of prolonged storage, study..... 268-269
curing investigations..... 268
deterioration, studies..... 449
preparation under supervision of Animal Industry Bureau, 1910..... 244-245
Melon aphis, control, studies in Texas..... 533-534
Melons, sugar content, proposed work..... 432
Melvin, A. D., report as Chief of Animal Industry Bureau, 1910..... 199-277
Metabolism, experiments, results..... 446
Meteorological data, collection and distribution by Weather Bureau..... 180-183
furnishing by Weather Bureau to Hydrographic Office, Navy Department..... 180-182
Mice, damage to forest seeds and seedlings, control measures..... 124, 551
poison, strychnine and oatmeal effective..... 124, 551
Microchemical laboratory, investigations, 1910..... 450-451
Midge, sorghum, investigations..... 531

Digitized by Google

Page.
Milk adulteration, prosecutions, Food Inspection Laboratory 459
use of water 458–459
city supplies, investigation and improvement 236–237
condensed, industry, cooperative study 456
investigations by Chemistry Bureau 102, 459
distribution cost 20
effect of feeding cotton seed and by-products 239
evaporated, investigations 459
human, composition, comparison with cow's milk, study 239
inspection, score-card system, use and results 236–237
interstate shipments, investigations 103
investigations, 1910 ..... 47, 141, 238–239, 264–265
market, investigations in 1910 ..... 236–237, 264–265, 456
pasteurized commercially, study 238–239
tests 264–265
prices, dairyman's share 20–21, 24
secretion, cooperative experiments and results 239
supply for cities, improvement, studies 46–47, 236
tuberculous cows, pasteurization experiments 276, 277
various cities, study of quality 456
Millet, drought-resistant varieties, studies 86
Milo, production in drought 312
Missouri, farm management, cooperative 329
Mite, responsibility for skin disease, studies 530
Molds, studies by Animal Industry Bureau 241
Moneys, public, receipts from various sources 573–574
Mongcose, exclusion from United States, note 128
Monodontomerus, European, moth parasite, importation, increase, etc 116, 517
Montana, cooperative study of spotted-fever transmission by ticks 537, 538
investigation of tick-harboring rodents 124–125
forest protection from insects, remarks 118
gid in sheep, studies 207, 272
necrobacillosis in sheep, control methods, quarantine area, release, etc 206
Moore, Willis L., report as Chief of Weather Bureau, 1910 161–198
Morning glories, control, remarks 333
Mosquitoes, control studies, Entomology Bureau 536–537
Moth, brown-tail, importation on nursery stock from Europe 542–543
work of Entomology Bureau in various States 510–517
codling, work of Entomology Bureau 526–527
European leopard, destruction by parasites, experiments 517–518
gipsy, infested area, location, and extent 510
work of Entomology Bureau in various States 510–517
injury to imported figs 450
nests, importation on European seedlings, inspection and preventive methods 542–543
Mediterranean flour, investigations 539–540, 541–542
Moths, control, cooperation of railroads with Federal and State authorities 514
gipsy, brown-tail, and European leopard, work of Entomology Bureau 113–116, 510–518
insect enemies, importations from various countries 514–518
Mount Weather Observatory, work, 1910 ..... 37–38, 161–166
Mulberry scale parasites, exportations to Italy 518
Mustard, studies 451
Mycological work, Animal Industry Bureau, 1910 241

Nashville laboratory, food and drug inspection work, 1910 469
National forests. *See* Forests.
Naval stores, exports, value, 1910 19
Navy Department, meat-inspection work for, by Animal Industry Bureau 246
Necrobacillosis, sheep, control methods 49, 206, 248, 257
Negroes, share in cooperative demonstration work 337
Nematodes, crop infesting 303
New England States, moth damage, and investigations 113–116
Hampshire, moth control, work of Entomology Bureau, 1910 ..... 113, 116, 511
Jersey, grape investigations 350

Digitized by Google

	Page.
New Mexico, biological survey, completion	127
range caterpillar, investigations	530–531
Orleans laboratory, food and drug inspection work, 1910	469
York laboratory, food and drug inspection work, 1910	470–472
Nitrites, pharmacological studies	445
Nitrogen, atmospheric, manufacturing methods, studies	502
determination methods, studies by Chemistry Bureau	484–485
fixation and use as fertilizer	502
Nitrogen-gathering bacteria, work	288
North Carolina, experiments with seedless Chinese persimmons	79
study of strawberry insects by Entomology Bureau	532–533
tobacco investigations	318
Dakota, diversified farming	329
Experiment Station, tests of Holstein cattle for tuberculosis	214
reconnoissance surveys, 1910	499–500
Notices of Judgment, cases of year	804–846
Nurseries, National Forests, location	387
Nursery stock, European countries, study of inspection methods	543
inspection for insect control	119
work, Arlington Experimental Farm	339
Nutrition, animal, comparative studies of glucose and cane sugar	449
experiments at State College, Pennsylvania	217
investigations, Experiment Stations Office, purpose and history	148–150
work, plans for future, etc	765–766
work, practical value, demonstration	149–150
Nuts, cashew, analysis and testing	464–465
Oat investigations, remarks	66–67, 313
Oats, bleaching, investigations	456
crop, 1910, value and yield	13
Object-lesson roads, work of year	153
Observatory buildings, new, construction	191
Weather Bureau, owned and rented	191–192
Mount Weather, work, 1910	161–166
Ocean charts, description, number issued, etc	622
Office of Public Roads. *See* Roads, Public, Office.	
Ohio, experiments in timothy breeding	84
Oil and oil-cake meal, exports, value, 1910	18
Haarlem, misbranding, investigations by Chemistry Bureau	460
olive, adulteration with other oils, studies	458
denaturants, inspection by Chemistry Bureau	471
peanut, commercial possibility	340
producing plants, studies	60
production, use of soy beans	327
soy-bean, use in oleomargarine manufacture, study	267
volatile, experiments	296
wood, tree, Chinese, introduction and value	78
Oil-cement concrete investigations, Public Roads Office	157
Oils, action on metals, laboratory studies	268
citrus, laboratory investigations	437–438
edible, cooperative studies of soy-bean and peanut products	439
essential, misbranding, investigations	440–441
samples, collection by inspectors	456
Oleomargarine, manufacture from imported oleo stearin	245
Olive oil, adulteration with other oil, studies	458
denaturants, inspection by Chemistry Bureau	471
oil-making varieties, note	142
Olives, imported, wormy condition, studies	451, 457
Olmsted, Victor H., report as Chief of Bureau of Statistics	695–722
Omaha laboratory, food and drug inspection work, 1910	472–473
Onion investigations, remarks	341
thrips, control, studies in various States	533–534
Operation Branch of Forest Service, plans for future work	421–422
Orange groves, protection from insects	117–118
rust of apple, prevalence, control, work, etc	54
thrips, control, studies	535–536

Digitized by Google

Page.
Oranges, immature, picking and handling, study of methods.... 437, 455
injury by Argentine ant.... 521–522
types, comparison and selection, studies.... 437
Orchard diseases, study.... 282–284
sprays, note.... 54
Orchards, Pacific coast, insect control.... 525–527
sprayed and unsprayed, comparison, proposed work.... 525
Orders, general and special, of Secretary.... 891–896
Oregon, forest protection from insects, remarks by Secretary.... 119
soil surveys, cooperation of State.... 498
Ornamental trees, acclimatization.... 295
disease studies.... 286
Ornithological Congress, International, note.... 130
Ornithology, economic, plans for future work.... 564
Overflowed lands, drainage surveys.... 762
Oysters, cove, shipment, study of legality.... 438
handling and shipping methods, study.... 103, 433–434
violations of law.... 456
Ozark mountain region, fruit growing, investigations.... 351
region, Missouri and Arkansas, completion of reconnoissance soil surveys, area, etc.... 110

Pacific coast, grain investigations.... 309
soil surveys, cooperation of States.... 498
Packing houses, rat eradication, cooperative studies.... 269
Packing-house products, exports and imports, value, 1910.... 18
Page, Logan Waller, report as Director of Office of Public Roads, 1910.... 767–792
Paint, rust-proof, study, Public Roads Office.... 157
use as rust preventive for iron and steel.... 789–790
Palestine, agricultural explorations, results, etc.... 355
wild wheat, drought-resistant, study.... 77
Palm, coconut, bud-rot, studies.... 53
Panicum, genus, study of botany.... 305
Papaya, improvement, experiments at Hawaii station.... 753
Paper, plants suitable for making, investigations.... 62
tests, appropriation, disbursements, and balance.... 569
by Chemistry Bureau for various departments.... 481–482
use of various plants as stock.... 302
Paper-making materials, study by Chemistry Bureau.... 451, 481–482
Paper-plant investigations, discussion.... 301–302
Parasetigena, gipsy moth, parasite, importation, 1909.... 516
Parasites, animal, studies by Animal Industry Bureau, 1910.... 272–274
collection, additions by Animal Industry Bureau.... 274
gipsy and brown-tail moth, importations and laboratory work.... 514–518
moth, introduction against gipsy and brown-tail moths.... 115–116
Paris green, use in tobacco hornworm control.... 520
Partridge, introduction, note.... 129
Pasture lands, national forests, investigations.... 402–404
management, study.... 334
Pastures, experiments.... 359
influence on beef production, studies.... 81
run-down, rejuvenation, studies.... 81
Patents, department employees, work of Solicitor.... 888–889
Pathological Division, Animal Industry Bureau, work, 1910.... 257–266
Pathology, plant, collections and inspection.... 282
investigations.... 281–287
Peach brown-rot, control by spraying.... 284
Chinese, use as stock for stone fruits.... 77, 356
growing, value of self-boiled lime-sulphur fungicide.... 54–55
Peaches, precooling experiments.... 349
value as vinegar stock, study.... 437
Peanut investigations, remarks.... 340
Pear blight, eradication.... 55, 283
scale, European, control experiments with sprays.... 528
thrips, control, work of Entomology Bureau.... 121, 525–526
Peas, canned, analysis and testing.... 465

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	Page.
Peat, acidity, requirements for growing blueberries	447–448
Pecan, insects injurious, study by Entomology Bureau	545
investigations	352
study of scab and other problems	55, 283
Pediculoides ventricosus, enemy of jointworm and parasites	530
Pedigree record associations, supervision	218–219
Pellagra, relation of corn, remarks	298
Penicillium, mold species, studies	241
Pennsylvania State College, cooperation with Soils Bureau	110
Pepper, paprika, demand, growth of industry, etc	59
Peppermint oil, investigations	441
Perfumery plants, outlook for study	299
Perfumery-plant investigations, remarks	296
Perishable products, handling	157
Permits, grazing, National Forests, numbers and kinds	397–399
Persimmons, Chinese seedless, experiments in North Carolina	79
Japanese, experiments	344
ripening methods, study	437
Personnel, Committee, work, cases, etc	889
Pheasant propagation, note	129
Philadelphia laboratory, food and drug inspection work, 1910	473–474
Phosphates, use as fertilizers, nature, value, etc., cooperative studies	502–503
Phosphoric acids, quality, investigations	447
Phosphorus, occurrence in wheat and cotton-seed meal, study	449
Physical investigations, Plant Industry, remarks	325
Physiological investigations, review	298–299
Pine, white, experiments in thinning	410
seedlings, blister rust, control method	55
Pineapple disease, investigations and control experiments	146
dried, method of preparation, study	437
growing, experiments at Hawaii station	752
Pineapples, study, note	142
Pittsburg laboratory, food and drug inspection work, 1910	474–475
Plague, danger of becoming endemic through ground squirrels	122–123
infection of wood rat, note	127
spread by animals and insects, notes	121, 122
transmission by California ground squirrels, control measures, etc	550
Plant breeding, experiments with alkali and drought-resistant varieties	72–73
diseases, cooperative studies	281
studies at Port Rico station	754
food, absorption by plants, work, Chemistry Bureau	448
secondary elements, functions	319
growth, early stages, studies	449
influence of fertilizers, investigations by Soils Bureau	506
Industry Bureau, appropriation, disbursements, and balance	570
contracts, leases, and bonds, number prepared by Solicitor	887
cooperation in study of wheat and bleached flour	466
with other executive departments	100–101, 447–453
cooperative studies of citrus fruits	437
codling moth control	527
fruit and fruit products	436
insecticides and fungicides	479–480
force, number, and classification	902
officers	910–911
organization and policy, changes	280
publications issued during year, new and reprints	681–688
report of Acting Chief, 1910	279–362
review of work by Secretary	53–86
introduction, progress	77–79
nutrition, investigations, remarks	318
pathology, investigations and work	53–57
physiology, investigations	106–107
Planting crops, dates, investigations by Bureau of Statistics	701–702
Plant-introduction gardens, work	355–357

Digitized by Google

Page.
Plants, alkali-resistant, breeding, investigations 72–73
Congressional distribution 361
drought-resistant, breeding, investigations 72–73
economic collections, remarks 306
foreign, introduction, work 355–360
imported, inspection for insect infestation 542
nutrition ratios 319
ornamental, Alaska, experiments 750
Plum curculio, spraying, work of Entomology Bureau 528
Plumage, traffic for millinery purposes, legislation, etc 563
Plums, study, remarks 306
Poison, ground squirrel, effective use of strychnine on barley 123
mice, strychnine with oatmeal effective 124
prairie dog, strychnine with oats effective 125
suggestions for use 551
squirrel, suggestions for use 550, 551
Poisonous-plant investigations, review and outlook 60–61, 297–298, 300
Poisons, use against rodents, suggestions 550, 551
in tobacco-insect control 520–521
Pollination experiments, apple, remarks by Secretary 141
Pomological collections, review of work 343
work 352
Pomology, field investigations 75–76, 343
Population, relation to agricultural production 708–710, 713–716
Pork production, investigations in Alabama 218
Portland laboratory, food and drug inspection work, 1910 475
Porto Rico, Experiment Station, review of work by Secretary 146–147
work, 1910 753–755
live-stock diseases, studies, 1910 255
mango growing 77
Post Office Department, cooperation with Chemistry Bureau in fraud cases. 442–443
Potato beetle, Colorado, destruction, use of lime-sulphur, etc 532
botanical origin 306
diseases, need of investigations and work, remarks by Secretary 56–57
study 286
Irish, investigations 340
sweet. *See* Sweet potato.
wart, danger of introduction, remarks by Secretary 57
wilt, nature of injuries, need of investigation, etc 56
Potatoes, crop, 1910, yield 13
new varieties, need, note 56
production per acre for several years 711, 712
Poultry, deterioration, studies by Chemistry Bureau 429–432
diseases, study 263
feeding tests and experiments 44–45, 216–217
hybrid, breeding experiments 216
investigations, 1910 ..... 44–45, 215–217
by Chemistry Bureau 101–102
prices, farmer's share 21–22, 24
shipping, dressing, storage, etc., investigations 429–432
Powell, G. Harold, report as Acting Chief, Bureau of Plant Industry, 1910.. 279–362
Power companies, occupancy of national forests, regulations 371–373
Prairie dogs, control, measures and investigations 125
destruction, investigations by Biological Survey 551
Prescription remedies, examination of claims 445
Press lists, Publications Division, use, etc 623
notices, preparation and dissemination 623
Prices, high, investigation, special, 1910 ..... 20, 24
retail and wholesale, study 136
Prickly pear, breeding to produce spineless form 81
investigations, remarks 331–332
spineless, value as cattle feed 81
Printing, expenditures, various bureaus and offices 627–629
Office, department branch, discontinuance 624
Production and Distribution Division, Bureau of Statistics, work and proposed work 700–702

Digitized by Google

Page.
Products Branch of Forest Service, plans for future work 424–427
Propagation, plant, work 354
Pruning, effect on Rotundifolia grapes, note 142
Prunus, genus, systematic study 306
Public Roads Office. *See* Roads.
Publications, Agriculture Department, sales by Superintendent of Documents 134, 629–631
Animal Industry Bureau, 1910 211
Biological Survey, 1910, new and reprints 662–663
Chemistry Bureau, 1910 485
Department, 1910, classification by bureaus contributing 632–633
issued during year, class, title, number, etc 642–656
output, 1907–1910 629
distribution, avoidance of duplication 623–624
to foreign countries 639–640
Division, appropriations, disbursements, and balance 571
for 1907–1910 621
contracts and leases, preparation by Solicitor 887
force, number, and classification 906
officers 915
publications issued during year, new and reprints 688–690
recommendations of Editor and Chief for 1911 640–642
report of Chief 621–694
review of work by Secretary 133–137
Entomology Bureau, 1910, new and reprints 666–670
farmers' demonstration work 338
Forest Service, 1910, new and reprints 677–680
handling and distribution 636–640
Library 680, 726
Office of Experiment Stations, work, nature, etc 670–676, 745–748
Secretary, 1910 642–656
Solicitor 890
Plant Industry Bureau, 1910 ..... 280, 681–688
Public Roads Office, 1910, new and reprints 690
reprinted, nature, numbers, etc 630–631
Soils Bureau, 1910, new and reprints 691
Statistics Bureau, 1910, new and reprints 692, 702–703
Weather Bureau, 1910, new and reprints 190, 622, 692–694
change of methods 42
printing and distribution 165–166, 177–178, 190
Puget Sound, soil surveys, cooperation of State 498
Pyrheliometers, new, installation 164–165

Quack grass, study 333
Quarantine, animal, additional station, need of Atlantic Seaboard 209
cattle tick, areas released, 1910 ..... 48, 246–247
Division, work, 1910 248–257
imported animals 52
law, National, insect pests, necessity 543
laws for live stock, violations, cases 794
necrobacillosis in sheep, area released, 1910 206
scabies, cattle areas released in 1910 ..... 48, 206, 247
in sheep, establishment in Kentucky 206, 247
of sheep and cattle, areas released 48, 206, 247
station, location at Baltimore, note 209

Rabies, animals affected, examination at Department, results, etc 51
eradication, method recommended 51
investigations, cases diagnosed, 1910 261–263
Railroads, cooperation with Federal and State authorities in moth control 514
National Forests, cooperation with Forest Service in fire protection 91
Rams, sale by Animal Industry Bureau 213
Range conditions, National Forests 395–396
investigations, review 304–307, 332
management, National Forests 394–405
Raspberry, cross with salmon berry, experiment in Alaska 750

Digitized by Google

Page.
Rats, breeding experiments and results 215
control measures for health protection 122
disease-spreading, relation to bubonic plague 121–122, 127
eradication from packing houses, cooperative studies 269, 552
kangaroo, damage to canal banks 551
wood, Neotoma, monograph 127
Reagents, chemical, testing by Chemistry Bureau 446–447
Reclamation projects, progress of work at field stations 71–72
Service, request for soil survey, Truckee–Carson reclamation project 498
Recommendations by Secretary 41, 52–53, 95, 138
Reconnoissance surveys, work, 1910 498–501
Redbirds, importations, difficulties, etc 556
Redwood sawdust, use in packing and storage of grapes 344, 346
Reforestation, damage by rodents 124, 551
National Forests, methods, management, etc 87–88, 386–392
progress and proposed work 87–88
Respiration calorimeter, use in nutrition investigations 113–116, 765
Rhode Island, moth control, work of Entomology Bureau, 1910 ..... 113–116, 512
Rice crop, 1910, yield and value 15
growing, experiments at Hawaii station 146, 752
in Southern States 66, 151
insects, investigations 521
investigations, experiments, review of work by Secretary 66
remarks 312
irrigation, studies 760
mill investigations 540
weevil investigations, loss 521
River and Flood Division, Weather Bureau, work, 1910 172–175
service, work, extension, etc 40, 172–175
gauges, automatic, installation, value, etc 172–173
Road binders, experimental work of Public Roads Office 156, 784–786
building, advisory work of Public Roads Office 153–154
improvements, United States, statistical and economic studies 152–154, 787–788
materials, samples, laboratory testing by Public Roads Office 155, 783–784, 788–789
testing for various countries, States, departments, etc., by Public Road Office 153–154, 783–784, 788–789
systems, model county 783
Roads, construction methods, various materials, cost, etc., work of Public Roads Office 767–792
earth, construction methods, location, cost, etc., work of Public Roads Office 779–780
exhibit, installation at various expositions by Public Roads Office 768
experimental, studies by Public Roads Office 781
gravel, construction methods, location, cost, etc., work of Public Roads Office 773–774
macadam, construction methods, location, cost, etc., work of Public Roads Office 770, 771–773
model county, construction, study of systems 783
object-lesson, construction, material, cost, etc 153, 769–782
oil-gravel, construction methods, location, cost, etc., work of Public Roads Office 771
Public, Office, appropriation, disbursements and balance 572
contracts, leases, and bonds, preparation by Solicitor 887
experiments with oil-cement concrete 790–791
force, number and classification, increase, etc 768, 907, 916
increase in appropriations 768
investigation of dust preventives and road binders 784–786
lectures, advisory work, etc 153–154, 786–787
library, work, growth, etc 791–792
plans and recommendations for 1912 792
publications issued during year, new and reprints 690
report of Director, 1910 767–792
study of corrosion of iron and steel 789–790

Digitized by Google

Page.
Roads, Public, Office, work, review by Secretary 152–157
sand-clay, construction methods, location, cost, etc., work of Public Roads Office 774–779
Robin, enemy to gipsy moth, note 553
Rodents, dike borers, control, study 550–551
forest injuries by, remarks by Secretary 124
tick-harboring, relation to spotted fever, study 124–125
Root beer extracts, investigations 441
crops, aroid, experiments 357–358
rot, injuries to crops 327
Roots, danger in feeding to sheep 141
Root-worm, grape, studies of Entomology Bureau 527
Roquefort cheese, manufacture, experiments 241
Rosin, grading, studies by Chemistry Bureau 107, 482–483
Roundworms, sheep, experiments and results 272, 274
Rubber cultivation, Hawaii, experiments 146, 753
Rust, iron and steel, laboratory studies, Public Roads Office 789–790
Rusts, cereal, remarks 312
Rye crop, 1910, yield and value 15

Salaries, Agriculture Department, appropriation, disbursements, and balance 569
Salt, California and Utah, misbranding, studies 456
Salton Sea evaporation studies 41
San Antonio experiment farm 321
Francisco laboratory, food and drug inspection work, 1910 476–477
Sapsuckers, injury to timber, losses, investigations, etc 552
Sausage casings, coloring, poisonous ingredients, study 268
Sardines, canning, investigations, seizures, etc 456
Savannah laboratory, food and drug inspection work, 1910 477
Sawdust, redwood, use in storage of grapes, notes 344, 346
Scabies, cattle, quarantine, release of Western areas 207, 247
horses, inspection and control methods 247
sheep and cattle, eradication, 1910 ..... 48, 206–207, 247, 272–273
Kentucky, quarantine establishment 206, 247
quarantine area released, various States, 1910 ..... 207, 247
Scale parasites, exportations to Italy 518
School gardens, remarks 342
Schools, agricultural, increase, remarks by Secretary 142–143
movable, number, attendance, etc., note 743
relation to Office of Experiment Stations 740–742
boys' clubs in farmers' demonstration work 338
use of Farmers' Bulletins in classes, remarks by Secretary 134
Scientific publications, distribution and cost 134
work, publication of results, proposal and estimate for 139
Score-card dairy inspection, value in milk improvement 46
Scuppernong grapes, pruning, etc., studies, notes 141
Seattle laboratory, food and drug inspection work, 1910 477–478
Secretary of Agriculture. *See* Agriculture, Secretary.
Seed, beet, improvement of American, note 57
cotton, Congressional distribution 361
distribution, Congressional 86, 360–362
in cooperative demonstration work 338
foreign, introduction, work 355–360
forest trees, tests 389
grass, Congressional distribution 361
selection, lessons in demonstration work 338
testing laboratories, review 64, 307
Seeding grains, time and rate, study 65–66, 311
Seedlings, forest, damping off, control 56
French, importations, freedom from insect pests 543
white pine, importation, danger 55–56
Seismological work, establishment and equipment, recommendation 41
importance, studies by Weather Bureau 176–177
Semiarid regions, drought-resistant legumes, studies 86
Serum, hog cholera, manufacture and use, studies 50, 270–271
Serums, importation, necessity for control legislation 52, 209

Digitized by Google

Page.
Sesbania macrocarpa, investigation as paper plant, note 301
Settlement, National Forests, titles and claims 366–369
Settlers, irrigated lands, need of information, aid, etc 758–759
Sewage irrigation experiments, Iowa, crop yields 152
Shade trees, disease studies, note 286
insects injurious, studies by Entomology Bureau 545–546
Sheep, bighead, description, occurrence in West, studies 259–260
breeding, Alaska, experiments, etc 145, 750–751
methods, investigations 212, 213
danger from feeding roots to, note 141
gid, control methods, studies in Montana 207, 272
parasite, studies in Montana 207, 272
inspection, 1910 243–244
and dipping for scabies, number 48
necrobacillosis, studies in Wyoming and Montana 49, 206, 248
roundworms, eradication experiments 272, 274
scabies, control work, 1910 ..... 48, 206–207, 247, 272–273
varieties, Bethesda Experiment Station 213
woolless, introduction and breeding, Porto Rico 147
Shipping. *See* Transportation.
Shorthorn cattle, breeding experiments 214–215
milking experiments 214–215
Silk imports, value, 1910 18
Silos, dairy, study of construction 233
Silvicultural studies, Forest Service 408–411
Silviculture, Branch of Forest Service, plans for future work 422–424
Sisal growing experiments, remarks 63, 304
Slag, use in road building, experiments 788–789
Smelter fumes, effects on forests, etc., investigations 481
wastes, effects on agricultural products, stock, etc 481
examinations by Chemistry Bureau for various executive departments 106, 481–482
Smuts, cereal, remarks 312
Snowfall, measurement devices, description, equipment, etc 41, 178
water equivalent, determination experiments by Weather Bureau 174
Soda arsenite, use in weed eradication, Hawaii 146
use in cattle dips 273–274
"Soft drinks," medicated, examination 444
Soil bacteriology, investigations 57, 287–288
erosion, protective methods, studies by Soils Bureau 507
fertility investigations, work, 1910 503–506
maintenance, remarks by Secretary 139
mapping, entire State, necessity and value 496–497
relation to water, investigations 506–507
resources, United States, monographs of facts, publication 112
survey of logged-off lands in Puget Sound section 110
work, 1910, area and cost 107–112, 493–495
cooperation with State organizations 108, 110, 493, 495–497, 498
western division, progress 498
surveys, relation to agriculture 497
value in increased agricultural production 108–109
water, investigations, Great Plains, scope, value, etc 110–111
work, 1910 506–507
Soils, acidity, relations to grazing plants 305
arsenic accumulation, cooperative studies 527–528
Bureau, appropriation, disbursements and balance 571
force, number and classification 904
laboratory investigations for various departments 501–503
officers 914
organization, growth, etc 497
publications issued during year, new and reprints 691
report of Chief, 1910 493–507
review of work by Secretary 107–112
Chinese, comparison with American soils, studies, etc 502
fertility investigations, importance and value of work 111–112
laboratory investigations, scope, value, etc 111–112

Digitized by Google

Page.
Soils, organic matter, origin, etc. 503-506
physical and chemical, investigations. 503-506
Solar radiation, measurements, study, Weather Bureau, 1910 .... 41, 164-165, 175-176
recording apparatus, improvement 165
Solicitor, legal advice 793-794
Office, review of work by Secretary 33-36
work, report, 1910 793-895
opinions on questions involving the National Forests 871-872
report, 1910 793-895
Sorghum midge, investigations 531
Sorghums, grain, investigations, note 66, 312
improved, testing, results 359-360
Sotol, sugar content, study 449
South Carolina, aroid growing 78
paprika pepper growing, progress 59
tobacco investigations 318
Dakota, reconnoissance surveys, 1910 500
Soy bean investigations 360
oil production 327
use in manufacture of oleomargarin, study 267
Spider, cotton red, investigations and control methods 522
Spirits, distilled, handling, storage, etc., studies 438
Splitworm, tobacco, control investigations 520
Spotted fever, spread by ticks 121, 124, 538
Spraying apple, study and changes 233-284
fruit trees, methods, etc 524-529
insects affecting citrus fruits, experiments 534-536
moth, measure for control of gipsy and brown-tail moths 115
success against orange thrips 117
vegetable crops, cooperative experiments 532
Sprays, orchard, note 54
varieties, experiments with apricots in California 528
tests, etc 524-529, 532
Squirrels, California ground, transmission of plague, control measures, etc 550
ground, damage to forest seeds and seedlings, control measures 551
relation to spread of spotted fever, investigations 549-550
See also Ground squirrel.
St. Louis laboratory, food and drug inspection work, 1910 475
Paul laboratory, food and drug inspection work, 1910 475-476
Stallions, use in breeding horses for United States Army, number required, etc 224-225, 228-229
Starlings, early importation, result, investigations, etc 128, 556-557
State Department, cooperation in study of Haarlem oil 460
Statistics Bureau, appropriation, disbursement and balance 571
force, number and classification 906
officers 915
organization 695-696
publications issued during year 692
report of Chief 695-722
review of work by Secretary 135-137
studies of prices of beef and pork 136
Stearin, oleo, imported, use in manufacture of oleomargarine 245
Steel, corrosion, laboratory studies, Public Roads Office 156-157, 789-790
Stencils, use in addressing mail matter, document section 637-638
Stock breeding work, Kodiak station, Alaska 145
Porto Rico 147
Storage, apple, in California 348
effect on canned meats, study 268-269
fruits, investigations 75, 76, 345, 347
lemon, investigations 347
meats and fish, studies by Chemistry Bureau 449
Stored products, insects injurious, studies 539-542
Storm-warning stations, list 187-188
Strawberries, hybrids, experiments in Alaska 750
Strawberry insects, study in North Carolina 532-533

Digitized by Google

Page.
Strawberry weevil, control studies 532–533
Stream flow, effect of forest cover, studies 392–393
forest effects, cooperative studies of Weather Bureau and Forest Service 174–175
Strychnine, use against rodents, notes 550, 551
with barley against ground squirrels 123
Stumps, burning, methods for logged-off land 81
Subirrigation, influence on soil productivity 506–507
Sugar analysis, methods, studies 433
and molasses imports, value, 1910 18
beet, production and value, 1910 13–14
beets. *See* Beets, sugar.
cane insect investigations 521
nutritive value for animal food, experiments 449
production and value, 1910 14
laboratory work, 1910 ..... 432–433, 456
plant investigations 287
production and value, 1910 13–14
products, laboratory work, 1910 432–433
Sulphur spray for orchards, note 54
use in bleaching oats and barley 456
cattle tick control, experiments 537
Supplies, analysis of samples 107
annual, advertising methods, etc 573
Weather Bureau, contract methods 190–191
contract, examination by Chemistry Bureau 483–484
Division, Weather Bureau, work, 1910 190–191
Supply contracts, preparation by Solicitor 888
Surveys, reconnoissance, of large areas, by Soils Bureau 109–110
Swamp fever, among horses, studies 257–258
lands, drainage surveys 762
Sweet potato investigations, remarks 341
Swine, inspection, 1910, number 243–244
responsibility for tapeworm in man in Honduras 256
See also Hogs.
Swiss cheese, work at Albert Lea, Minn., 1910 239–240
Synthetic products, investigations, Chemistry Bureau 441–442
Laboratory, work, 1910 441–442

Tanning plants, crop, work, note 60
Tar, pine, use in cattle dips 273–274
Taxonomic investigations, review 304–307
Tea culture, investigations, remarks 297
growing, work in South Carolina 60
prices, increase on import value 24, 25
Teachers, Farmers' Institutes, need 744
Technologic work, general, of Plant Industry Bureau 302
Telegraph, wireless, service, Pacific coast, Weather Bureau, work, 1910 182
work, Weather Bureau, 1910 189–190
Telephone work, Weather Bureau, 1910 189–190
Temperature, normal, 1873–1909, preparation of charts by Weather Bureau 180
Tennessee, red clover, disease resistant, production experiments 85
tobacco-insect investigations 520–521
Testing gardens, Florida and Wisconsin, notes 296
road materials, work of Public Roads Office 153–155, 783–784, 788–789
Texas fever, control work, 1909–10 ..... 47, 205, 246
spread, responsibility of cattle ticks 47, 205
study of organism 274
southern, reconnoissance surveys, 1910 ..... 499, 500–501
truck-crop insects, investigations 533–534
Thermometer, electrical resistance, description, installation, etc 175–176
Thrips, onion, investigations 533–534
orange, control, studies 117, 535–536
pear, control, work of Entomology Bureau 121, 525–526
tobacco, control investigations 520
Tick, cattle, quarantine area released 205, 246–247

Digitized by Google

Page.
Tick, dog, parasites, exportations to Italy 518
fever, control studies 47–48, 537–539
fowl, control studies 538–539
Texas fever, occurrence in National Forests, effect, etc 401
Ticks, cattle, eradication, cooperation of Federal and State authorities 205, 246–247, 273–274
expenditures, Federal and State, 1909–10 205
experiments with arsenical dips, etc 205, 273–274
work, 1910 ..... 47–48, 204–205, 246–247, 256–257, 273–274, 537–539
prevalence in Honduras 256, 257
Southern States, pecuniary losses 205
disease-spreading, relation to spotted fever, notes 121, 124
disease-transmitting, study by Entomology Bureau 121, 537–539
Tillage, corn, weed destruction, studies and demonstration work 81
studies 81, 333
Timber, beetle-infested, barking, cost per tree 523
cut, National Forests 380
cutting from National Forests, management 382–385
engineering studies 414
free use on National Forests, permits 386
injury by woodpeckers 552
National Forests, stand and distribution, cut, and free use 375, 380, 386
physical studies 414
rot, study proposed 285
sales, National Forests, amount, prices, etc 95–96, 380–386
saving of losses by insects, notes 118, 119
trespass, National Forests, payments 385–386
waste, utilization by Forest Service, methods 96
Timothy, breeding experiments in Ohio 84
improvement 359
value as forage crop 83–84
Tin, contamination of food products, investigations 438–439, 458, 464
Tobacco crop, 1910, yield and value 14
exports and imports, value, 1910 18
hornworm, investigations 520–521
Porto Rico, destruction by parasites, studies 518
insects, investigations 520–521
investigations, review 68–69, 315–318
production per acre, increase since 1886 ..... 27, 28
variations for many years 711, 712
seed, Congressional distribution 361
Tools, improved, increase in use, note 338
Transportation, fruits, investigations 75–76, 344
laws, live stock, violations, etc 248
lemons, study 346
live stock, need of additional legislation 52, 210
Treasury Department, cooperation with Agricultural Department in zoology index-catalogue 274
Trees, beetle-infested, disposition, and results 523–524
drought-resistant, introduction from Asia 78
protection from moths 113–115
shade, insects injurious, studies by Entomology Bureau 545–546
Trespass, grazing, National Forests 396–397
settlements 884–885
Tribalium ferrugineum, flour beetle species, studies 539
Tropical crops, acclimatization 295
Truck crops, diseases, investigations 286
fertilizers, experiments 341
insects, cooperative experiments in Virginia and Colorado 532–533
investigations 532–534
investigations, review of work 73
survey, remarks 342
See also Vegetable crops.
Truckee-Carson Experiment Farm, remarks 321
TRUE, A. C., report as Director of Office of Experiment Stations 735–766

Digitized by Google

Page.
Trypanosoma Americanum, cattle, studies 274
Tuberculin, preparation and distribution by Animal Industry Bureau 51, 271
tests, cattle for importation 250
number reacting, etc 250–254
State and other cooperation with Animal Industry Bureau, 1910 250–254
Tuberculins, importation, necessity for control legislation 209
Tuberculosis, bovine, District of Columbia, measures for suppression 49–50
eradication in District of Columbia 207, 253–254
investigations by Animal Industry Bureau 207, 250–254, 263–264, 271, 275–277
tests of Animal Industry Bureau upon Indian reservations 254
Tuberculous cattle, isolation experiments 276
cows, tests 264–265
Turpentine, grading, studies by Chemistry Bureau 482–483
investigations by Chemistry Bureau 107
Turpentining operations, National Forests, permits 381
Twenty-eight hour law, enforcement, court decisions, etc 35, 847–853
violations, cases 794
Typhoid fly. *See* Fly, house.

Udo, Japanese salad plant, introduction and use 78
Umatilla Experiment Farm, remarks 322
Utah, irrigation investigations, cooperation 151

Vaccine, blackleg, preparation and distribution, 1910 ..... 51, 261
Vaccines, importation, necessity for control legislation 209
Vanilla extracts, analysis and testing 464, 466
Vapor, water, amount in atmosphere, determination 165
Veal, immature (bob veal), investigations 265
Vegetable crops, insects injurious, work of Entomology Bureau 532–534
See also Truck crops.
seeds, Congressional distribution, award of contract for packing, etc. 360–361
testing, remarks 341
Vegetables, Guam Experiment Station 757
high prices, farmer's share, notes 22, 24–25
pathological conditions, remarks 298, 299
storage, remarks 298
Vegetation, natural, relation to drought, remarks 325
Vermont, horse-breeding experiments, 1910 211–212
moth damage and investigations 113–116
Vessel-reporting service, Weather Bureau, work, 1910 182–183
Vessels, inspection by Quarantine Division 248, 249
Veterinary education, studies at various colleges 211
work, necessity in connection with animal husbandry 31
Vinegar, adulteration, analysis and testing 471
cider, manufacture, study and experiments 438, 455, 471
investigations 100
use of peaches in manufacture, study 437
Virginia, cooperative investigations of truck-crop insects 532
tobacco investigations 517
Viticulture, investigations 76, 350

Wages, farm labor, investigations by Bureau of Statistics 137, 701
relation to food prices, factor in increased cost of living 716–722
War Department, cooperation with Agriculture Department in horse-breeding study 208, 219–229
Forest Service 406
Water courses, improvement, etc., drainage surveys 762
influence on agricultural production 506–507
irrigation, waste under old methods 150–151, 759–760
losses in irrigated regions, investigations, etc 150–151, 759–760
power, national forests, importance, regulations, etc 371–373
purification work, note 288
Waters, mineral and table, examination work by Chemistry Bureau 479

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Page.
Weather Bulletin, daily, publication, increase ... 189
Mount Weather, changes, scope, etc ... 165–166
National, publication, scope, etc ... 177–178
Bureau, appropriation, disbursements, and balance ... 572
contracts and leases, preparation by Solicitor ... 887
cooperative study with Forest Service of forest effects on stream flow ... 174–175
data, publication ... 165–166, 177–178
employees, examination for promotion, 1910 ... 185
evaporation study, cooperation with Forest Service ... 180
force, number and classification ... 901
forecasts and warnings, press notices, notes, etc ... 38–40, 166–172
officers ... 909–910
personnel, changes, statistics, 1910 ... 193–198
publications, 1910, new and reprints ... 622, 692–694
records, examination and verification, total number ... 189
report of Chief, 1910 ... 161–198
school of instruction, work, 1910 ... 185
work, review by Secretary ... 36–42
conditions, Southern States, remarks ... 335
maps and bulletins, description, number, etc ... 622
publication in newspapers, results ... 188–189
methods, changes ... 42
research work ... 37–38
Review, Monthly, new methods, scope, etc ... 177–178, 190
warnings, distribution, results, press notices in various cities, 1910 ... 38–40, 166–172
Weeds, destruction, use of arsenite of soda ... 753
eradication by spraying, experiments in Hawaii ... 146
studies ... 81, 333
Weevil, alfalfa, investigations ... 531
cotton-boll. *See* Boll weevil.
rice, investigations ... 521
strawberry, studies ... 532–533
Weevils, presence in corn and stored cereals, prevention methods ... 541
Wheat, breeding and acclimatization ... 294
composition, effect of soil exchange, studies ... 448–449
studies by Chemistry Bureau ... 448–449
content, effect of shade, studies ... 447
crop, 1910, yield and value ... 12
drought-resistant, study in Palestine ... 77
durum, production, note ... 65
handling, etc ... 308
laboratory experiments for nitrite determination in flour ... 448, 466
production per acre, increase since 1886 ... 27, 28
variations for many years ... 710–711, 712
purchasing power of 1 acre, 1899 and 1909 ... 719–720, 721–722
samples, milling experiments ... 448
storage under commercial conditions, studies ... 64
varieties, elimination tests ... 447
winter, extension of cultivation ... 65, 309
White fly, control, measures and study ... 117
studies and experiments in Florida ... 534–535
House, protection from lightning, Weather Bureau plans ... 176
pine, blister rust, control in seedlings ... 55–56, 285
seedlings, blister-rust, control method ... 55–56, 285
WHITNEY, MILTON, report as Chief of Soils Bureau, 1910 ... 493–507
Wild onions, eradication, remarks ... 333
WILEY, H. W., report as Chemist, 1910 ... 429–491
Willow, basket, investigations ... 410
WILSON, JAMES, report as Secretary of Agriculture, 1910 ... 9–158
Wine, grades, laboratory studies ... 455–456
Wines, composition, study of samples ... 452
Wintergreen oil, adulteration, detection ... 440
Wire, fence, rusting, investigation ... 156
Wireworm, tobacco, control investigations ... 520

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Page.
Wisconsin, forest products investigations, cooperation with Forest Service.. 97-98
irrigation experiments..... 152
Women, Farmers' Institutes, work, etc..... 144, 743
Wood rats. *See* Rats.
Utilization Office, transfer to Chicago, investigations, etc..... 415-418
Wood-oil tree, Chinese, introduction and value..... 78-79
Woodpeckers, injury to timber..... 552
Wool imports, value, 1910..... 18
Worms, presence in imported figs, laboratory studies..... 450, 457
Wyoming, biological survey, progress of work..... 127
irrigation investigations, cooperation..... 151
necrobacillosis in sheep, control methods, quarantine area release, etc..... 49, 206, 248

Yearbook, 1909, change in size, prompt issuance, etc..... 627
Yeast, analyses by Chemistry Bureau..... 449
cultures, distribution, 1910..... 453
Young people, Farmers' Institutes..... 144, 743
Yuma experiment farm, remarks..... 321

ZAPPONE, A., report as Chief of Division of Accounts and Disbursements.... 567-619
Zebra, hybrids, breeding experiments at Bethesda, Md., experiment station. 215
Zebra-ass hybrids, breeding experiments..... 44
Zones, life and crop, revision and additional work..... 126
Zoology, medical and veterinary, index-catalogue, cooperative preparation and publication..... 274
Zygobothria, moth parasite, importation..... 517

O

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